HARVEST INDEX, TOTAL DRY MATTER, YIELD AND YIELD COMPONENTS IN FABA BEANS (*Vicia faba* L.)

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James Ralph Neal

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ABSTRACT

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In a two year study, 535 faba bean accession strains were characterized for harvest index, dry matter production, yield and yield components. All data was collected on field grown plants during the summers of 1980 and 1981. A cross breeding program was also initiated to examine the fate of these yield parameters in six F1 hybrids.

Mean seed yield and dry matter production were approximately double in 1980 compared to 1981. This reflected the environmental variation between years. Rank correlation analysis indicated that, relative to each other, accession strains responded similarly over both years despite the differentials in absolute yield and dry matter production.

Frequency distributions showed reasonably normal patterns for all traits examined with a weak tendency for the population to separate into *major* and *minor* sub-groups based on 1000 seed weight.

Simple correlation analysis, simple regression analysis and multiple regression analysis were employed to further examine the interrelationships of yield and yield related traits. Several multivariate statistical techniques including path co-efficient analysis, discriminate analysis and factor analysis were also invoked to further partition yield.

In both years, approximately 80% of yield variability was accounted for by three yield related traits: total dry matter production, 1000 seed weight and pod number per plant. The addition of seed number per pod, plant height, stalk number per plant and number of days to first flower to the model increased the R^2 values to 85% and 88% in 1980 and 1981 respectively.

The F1 hybrids were evaluated at two densities: commercial production density (plot density) and spaced plant density. In the high density experiment, the F1 heterotic yield response, which ranged from 19% to 83%, was significant in four of the six crosses. At spaced plant density, five of the six F1's exhibited significant yield heterosis with increases ranging from 22% to 182% over the mid-parent values. Differences in yield structure were observed among F1 hybrids.

The correlation between spaced plant traits and plot density yield revealed that spaced plant yield was the best predictor of plot density yield. Dry matter production and harvest index also showed significant correlations.

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INTRODUCTION

Faba beans (Vicia faba L.) are still a relative newcomer to commercial production hectares in Western Canada, but their potential is highly regarded. The crop is well adapted to Manitoba conditions, and production has risen from zero hectares in 1971 to 8,900 hectares in 1980. As an erect legume high in protein, faba beans are in demand from both foreign and domestic markets.

A major source of concern with faba beans, both in this country and abroad is yield stability. The crop has shown, many times, an extremely high yielding ability; but consistent yield stability has been lacking. Figure 1 gives an insight into the seasonal variation in average yields in this province over the past years.

The problem of yield stability (or lack thereof) is one focus of the faba bean plant breeding program at the University of Manitoba. Efforts are being made to produce varieties better adapted to Manitoba conditions, and to this end the first Canadian cultivar, Aladin (McVetty et al. 1981) was released in 1981.

In order to better understand yield, and hence improve the efficiency of breeding for yield, plant breeders have introduced several concepts to quantify this complex trait. These concepts include harvest index, dry matter production, and yield component analysis. With the goal in mind to further our understanding of how yield is obtained, these concepts have been adopted in the faba bean breeding program at this institution.

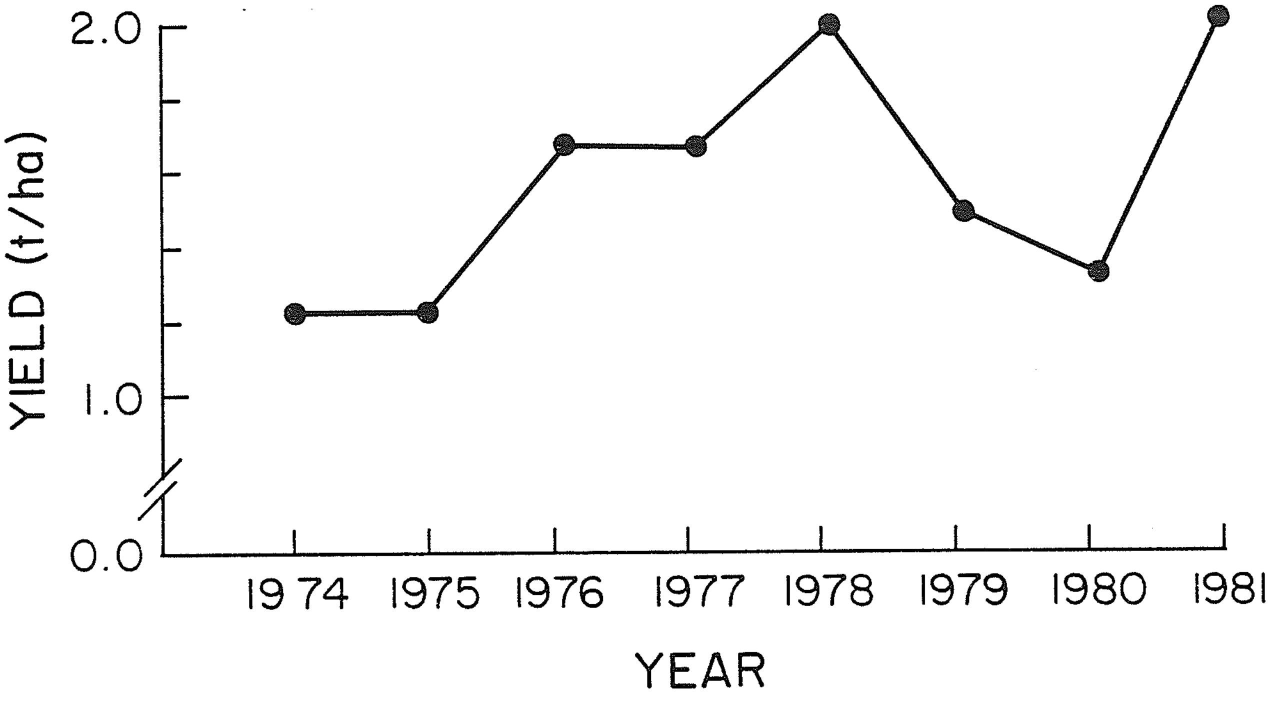

FIGURE 1. Average yields of faba beans in Manitoba, 1974-1981 (after Slinkard and Buchan 1980)

As a genetic base, the University of Manitoba program draws on an accession collection of over 500 Vicia faba L. strains from around the world. For the most part, this collection is largely uncharacterized as regards performance under Manitoba conditions. It is imperative that plant breeders have meaningful, reliable information about the genetic stocks on hand in order that effective use can be made of accession material.

A major objective of this research, therefore, was to characterize the current University of Manitoba faba bean collection. It was necessary to obtain information concerning: (i) the range of variability available for exploitation, (ii) the distribution of variability within the collection, and (iii) the environmental influence, as observed over two years of study. A large number of traits were examined including yield, dry matter, and yield components.

The second major objective of this research was aimed at an examination of F1 heterosis. As a partial outcrosser, it was expected that faba beans would in fact show F1 hybrid vigour. What was not so obvious was the degree to which heterosis would be expressed under Manitoba conditions, and the significance of this to a plant breeding program. The crossing program also afforded an opportunity to examine the fate of yield components, harvest index, and dry matter in the hybrids.

LITERATURE REVIEW

General Introduction.

Depending on the country in question, the species *Vicia faba* L. is known by any number of names including faba beans, field beans, broad beans and tick beans (Bond 1979). For the purposes of this paper, the common name faba bean will be used in reference to *Vicia faba* L.

The species is diploid with 2N=12. Taxonomically, *Vicia faba* L. is sub-divided into four subspecies based mainly on seed size: *major*, *equina*, *minor*, and *paucijuga*. This subspecies definition is somewhat arbitrary, especially since no cross incompatibility between subspecies is expressed, and in actual fact only the *paucijuga* subspecies has been subjected to any natural isolation mechanism (Cubero 1973).

There are no known wild forms of faba beans (Bond 1969; Cubero 1973), and the species will not cross with any other *Vicia* species (Bond 1969). The centre of origin is reported to be the Middle East (Bond 1969; Witcombe 1981). As for the derivation of the species, the situation is not clear. It has been proposed that ancestors exist within either *Vicia sativa* L.(2N=12) or within *V. narbonensis* L. (2N=14), but neither are strong candidates (Witcombe 1981).

As noted previously, there is no cross incompatibility within faba beans. Though there is a single case of intraspecific unilateral incompatibility in Egyptian material reported by Abdalla (1977), Toynbee-Clarke (1979) found no such expression in English material.

There do exist two distinct sources of cytoplasmic male sterility, however: cytoplasm 350, and cytoplasm 447 (Duc 1981). The CMS type 447 was discovered and described by Bond et al. (1964a, 1964b, 1966) and has received the dominant portion of scientific interest. Both types are unstable (Duc 1981), however, and have not been utilized commercially in the production of hybrids.

The species is partially allogamous (Darwin 1900; Holden and Bond 1960; Cubero 1976). Estimates of the degree of cross fertilization vary, with maximum rates reported in the neighbourhood of 60 - 70% (Holden and Bond 1960; Poulsen 1975). However, normal outcrossing is considered to be much less than these maximum figures, and in the range of 30% (Fyfe and Bailey 1951; Bond 1969; Witcombe 1981). Under Manitoba conditions, preliminary indications are that the cross fertilization rate is around 25% (McVetty, personal communication).[1] The partial allogamous nature of faba beans causes problems for plant breeders since traditional breeding programs designed for complete inbreeders, or complete outbreeders are unsuitable. In addition, the maintenance of germplasm collections is problematic since one must choose between open pollinated populations, inbred lines, or trait specific gene pools as the method of maintenance (Witcombe 1981).

For the most part, the economic product of faba beans is seed yield; though in some cases, where silage is the economic product, maximum dry matter production is the desired goal. There are usually two to four seeds (ovules) per pod (ovary) with one to five pods per node; the plant is an erect, stiff-stalked annual legume adapted to a wide range of

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[1] McVetty, P.B.E. Unpublished data.

climatic and cultural conditions (Bond 1969).

Yield and Yield Components.

In faba beans, as with all crops, breeding for increased yield *per se* is very difficult because of low heritability and environmental interaction with the yield trait. A common approach to this problem has been to attempt to further quantify yield, by partitioning it into more readily measurable morphological parts.

The first suggestion of the yield component approach was made in cereals by Engledow and Wadham (1923, 1924a, 1924b). They proposed that yield differences in cereals could be explained on the basis of three yield components, namely (i) average number of ear bearing tillers (ii) average number of grains per ear, and (iii) average weight of a single grain.

Cereal breeders have continued to employ the yield component concept in their research efforts since that time, with varying levels of success. In many studies, yield components have been shown to account for a significant amount of the variability observed in the yield trait (Waldron 1929; Frankel 1947; Fonseca and Patterson 1968; Walton 1972; Kaltsikes 1973). There are also many reports, however, of yield components failing as selection criteria due primarily to yield component compensation (Stephens 1942; Johnson and Schmidt 1966; Adams 1967).

Yield Components in Faba Beans. In faba beans, yield component studies are a much more recent phenomenon.

Rowlands (1955) reported that the three primary components of yield in *V. faba* L. were:

i) number of pods per plant.

ii) number of seeds per pod.

iii) seed size.

This study involved English material of both spring and winter types, and was the first reported examination of yield components in faba beans. Kambal (1968) compared yield components in Egyptian faba bean material, namely two cultivars (Rebaya 40 and Giza 1) and a local strain (Baladi). Though there was no difference between cultivars in yield per plant, the cultivars produced fewer pods and seeds, but their seed weight was greater than the local strain. It was reported also that pod number per plant showed the highest correlation with yield. Kambal (1968) further reported that between 95% and 98% of the yield variability was explained by seed number per plant, pod number, and seed weight.

Results which confirm the central role of pod number per plant as a primary yield component abound in the literature (Habib et al. 1971; Abdalla 1976; Magyarosi and Sjodin 1976; Foti 1979; Keller and Bellucci 1980).

In an examination of 12 Egyptian strains, Habib et al. (1971) found significant positive correlations among yield, plant height, and the number of pods per plant.

Yassin (1973) reported that yield per plot was closely and positively correlated with yield per plant, and pod number per plant, but negatively correlated with 1,000 seed weight. There was substantial genotypic variance for yield per plot, 1,000 seed weight, and pods per plant.

Poulsen (1974) partitioned yield in a slightly different manner. He found that 94% of yield variability could be accounted for by the mean yield per inflorescence, and the number of inflorescences in the yield bearing stem region.

Abdalla (1976) was able to show that at least one of the principal yield components, number of pods per plant, was an important determinant of yield which was common across the major, minor, equina, and paucijuga subspecies range. In studying 16 cultivars of widely diverse origin, he found a high correlation between seed yield and number of pods per plant.

In an apparent refinement of Poulsen's "number of inflorescences in the yield bearing stem region", Magyarosi and Sjodin (1976) reported that the number of podded nodes per plant showed the strongest correlation with yield per plant. As well, positive correlations with yield were reported for pod number per plant, the number of seeds per plant, and the number of seeds per pod.

Samia (1977) added to the weight of evidence favouring pod number per plant as the single most important yield component when he examined heterosis in some Vicia faba crosses. F1 heterosis over the better parent was mainly due to an increased number of pods per plant, and in no case did an F1 show heterosis for 100 seed weight.

Shaalan et al.(1977) examined the effect of row spacing on yield components in faba beans. In comparing 30 cm and 60 cm rows, they found no significant effect of row spacing on plant height, pod weight, seed weight, seed number per plant or seed number per pod. In a similar experiment in Sweden, Sjodin (1978) examined 12 cm, 24 cm, and 45 cm row spacing. His results differed from those of Shaalan et al.(1977) in that he found significant effects of row spacing and seed weight on yield. Large seeded cultivars performed better at a row spacing of 24 cm; whereas small seeded cultivars had an optimal spacing of 12 cm.

Salih and Salih (1980) studied the influence of seed size on yield in faba beans and concluded that there was no relationship between seed size and final yield. In this experiment, however, seed size, measured as 1,000 seed weight, was varied within cultivars only and so was an attempt to examine seedling vigour, rather than an attempt to uncover new genotypes.

Keller and Bellucci (1980) again emphasized the dominant role of pod number per plant as the most important yield component. In studying the effect of growth regulators on yield, it was found that treatment of the cultivar Herz Freya with giberellic acid (GA3) at the six leaf stage increased the number of pods per plant by 27% in 1977 and 25% in 1978. Concurrent with this increase in pod number, yield increased 18% and 40% respectively.

In a long term study, Picard and Berthelem (1980) reported that for 15 out of 25 years, and for any given genetically distinct type, yield stability was positively correlated with 1,000 seed weight. On the basis of this information, these authors suggested that early indications of yield stability can be determined by examining 1,000 seed weight at a range of different locations in a single season.

Though seed weight may be an indicator of yield stability, the results of de Vries (1981) would discount its role in breeding for high yielding ability. He reported that plants selected for higher yield were characterized by an increased number of seeds per pod, and an increased number of pods per plant, rather than increased seed weight.

Pandey (1981) examined the effect of planting density on yield components in faba beans. He reported a significant decrease in the number of pods per plant at higher densities, but the number of seeds per pod, and seed weight were unaffected by variation in density. These results regarding seed number per pod and seed weight are in agreement with those of Shaalan et al. (1977). However, it seems logical to assume that if seed number per pod is unchanged, and pod number per plant decreased with increasing density, then the number of seeds per plant decreased with increasing density also. This is in direct contrast with Shaalan et al. (1977) who showed no influence of density on seed number per plant.

El-Zahib et al. (1980) reported no effect of density on pod number per plant, seed number per pod, and seed weight.

Yield Component Genetics.

In other crops. Considerably less research effort has been expended in attempting to understand inheritance patterns and gene action governing yield components than has been spent on elucidating their physiological relations.

An early study by Woodworth (1931) revealed that yield components in wheat were inherited independently. This bode well for the yield component approach since, at least from these results, a complex genetic infrastucture was not apparent.

Frankel (1947), who also worked with wheat, suggested that yield components should only be used as a breeding tool with replicated homozygous lines, because the heritability of yield components was low.

Adams (1967), in a discussion of yield component compensation, maintained that the negative correlations observed between yield components were caused by physiological conditions rather than being genetically determined. Thus, he concluded that yield components could be used successfully as selection criteria in a breeding program.

Fonseca and Patterson (1968), on the other hand, arrived at exactly the opposite conclusion from their work with winter wheat. They found that strong negative correlations among yield components could indeed limit plant breeding progress based on these selection criteria.

Duarte and Adams (1972) examined yield components in field beans (Phaseolus vulgaris L.) and the effects of breeding for high, modal or low levels of expression of each separate component. They concluded that in families where divergent types were produced with respect to seed number per pod, and seed weight, these components assumed major roles in determining yield. This indicated that for P. vulgaris, at least, genetic variability and heritability levels allowed for successful breeding of divergent types.

Tonguthaisri (1977), who also worked with P. vulgaris reported that gene action was additive for pod length, seed number per pod, and 100 seed weight. This author also reported broad sense heritability estimates of 81% for 100 seed weight, and 90% for number of seeds per pod and numbers of seeds per plant. These results conflict with Frankel (1947) who reported low heritability as a limitation of yield components (as earlier discussed); however, it should be noted that this comparison is between two very different crops (wheat and peas) of two different habits (determinate and indeterminate).

In chickpeas (Cicer arietinum L.) a study by Kunadia (1980) indicated that the inheritance of yield and also the yield component, pod number per plant, was controlled mainly by non-additive gene action.

In faba beans. Rowlands (1958) was a pioneer in the examination of yield procurement in faba beans, especially with regard to the breeding system of the crop. In a study of ten spring varieties, he observed a range in mean pod number per plant from 16.7 to 38.8. In comparing open-pollinated progeny with their parents, he discovered that the number of pods per plant did not change between generations, but the number of seeds per pod declined significantly. The only yield component that was observed to be highly heritable was seed size.

Poulsen (1975) investigated further the effect of the breeding system on yield, and reported that the number of pods per plant was the yield component which showed the greatest response to mode of pollination (i.e. self or cross). These results are in agreement with similar experiments reported in the literature (Riedel and Wort 1960; Free 1966). Poulsen also reported higher seed weight following self-pollination, but suggested that this was a result of the lower number of seeds per pod, and lower number of pods per plant observed under self-pollination (Poulsen 1975).

Cubero (1976) conducted an intensive evaluation of seven V. faba lines of diverse origin. On the basis of a 7 x 7 diallel cross, he concluded that number of seeds per plant and number of pods per node showed overdominant gene action. Seed number per pod showed a similar tendency, but not quite as marked. Seed weight showed partial dominance.

Poulsen (1977) performed an analysis similar to that of Cubero (1976) in using a 7 x 7 diallel cross to investigate gene action. His results showed that all the yield components except number of pods per inflorescence showed high heritabilities ($T \geqslant 0.60$)(Mather and Jinks 1977). Seed weight was found to have a narrow sense heritability estimate of 95%, seed number per pod 79%, seed yield 60%, seed number per plant 63%, and number of pods per plant 73%. It was reported that most variation was due to additive gene effects, but some dominance effects were detected. Seed yield, pod number per inflorescence, and seed weight showed positive dominance effects (Poulsen 1977). The importance of additive genetic effects was corroborated by Suso (1980).

Mahmoud and Ibrahim (1978) reported that seed weight was controlled by polygenes or by 4 to 5 major genes with modifiers. They obtained broad sense heritability estimates between 44.3% and 77.2% for this yield component.

Lawes and Newaz (1979) found that yield components were controlled by genes with both additive and non-additive action. Seed yield was largely controlled by non-additive genes, a result which agrees with those of Cubero (1970) and Poulsen (1977).

Filippetti (1979) observed a wide range of genetic variability for several yield components including number of seeds per pod, and seed weight. This agrees with the results of Scarascia-Mugnozza and de Pace (1979). Filippetti (1979) also reported that high broad sense heritability estimates were obtained for number of seeds per pod and seed weight.

El-Zahib, et al. (1980) discovered very high broad sense heritability estimates for the following traits: pod number per plant (T=98.4%), number of seeds per pod (T=99.9%) and seed weight (T=84.3%). Seed yield per plant however, had a significantly lower broad sense heritability (T=21.3%). These authors also reported a very close negative genetic association between pods per plant and both number of seeds per pod and seed weight. Special breeding techniques were suggested to overcome this linkage.

It is apparent that the literature is not totally in agreement with regards the genetics of yield components in *V. faba.* It would seem safe to say that the heritability of seed weight is quite high. However, to make definitive statements with respect to heritability or gene action for the other yield components would be premature.

Harvest Index.

The search for a reliable selection criterion to assist in breeding for yield did not end with yield components. In fact, as alluded to in the previous discussion there are some difficulties with yield components which can be viewed as detracting from the advantages they offer to plant breeders.

In a more physiological vein, the concept of harvest index (HI) has received considerable attention. In simple terms, HI is the ratio of the yield of grain to the total above ground biological yield (Donald and Hamblin 1976). It is calculated by the following formula, expressed as a percentage:

$$\text{HI}\ (\%) = \frac{\text{seed yield}}{\text{total dry matter yield}} \times 100$$

In an extensive review of the role of HI in plant breeding, Donald and Hamblin (1976) discussed the origin and development of the HI concept.

The beginnings of the HI concept are attributed to Beaven (1914) who termed it the "migration co-efficient", and calculated it on a fresh weight basis. Engledow and Wadham (1923) examined indices of single plant yield, and concluded that only this "migration co-efficient" was of any value. The concept was largely disregarded until Nicoporovic (1960) re-introduced the HI idea under the name of "co-efficient of effectiveness of formation of economic yield". Finally, Donald (1962) proposed the terminology of HI for the concept and that denotation has remained.

Physiology. The value of HI has been highly touted by several authors as a means of measuring physiological adaptability and assimilate partitioning. Considerable interest has come from cereal breeders, and by far most of the literature deals with HI from that point of view.

Sims (1963) compared wheat cultivars produced in three breeding eras and found that HI increased with time to be highest in the most recently developed cultivars. There was no significant change in biological yield.

Syme (1970) examined nine wheat cultivars and found a highly significant correlation between yield and HI ($r = 0.96^{**}$).

Fischer (1975) sought to discover which traits measured on spaced plants would best predict plot density performance. He found that HI measured on a per plant basis, or on the central shoot, were the most closely correlated variables. (r=0.54** and r=0.65** respectively). The only other significant correlations were much lower: grain weight per plant (r=0.31*) and kernel weight (r=0.32*).

Okolo (1977) used the HI of F2 spring wheat plants as an estimator of F3 and F4 bulk yields. In four crosses, there was no significant correlation discovered. McVetty (1980) reported an opposite result in concluding that HI in a productivity and height framework was useful in enhancing wheat breeder's effectiveness in selecting high yielding potential genotypes.

In the indeterminate crop. HI is not only a recent and sometimes controversial concept but in addition, by having its origins in a cereal breeding context it is a term largely synonymous with determinate crops. The applicability to an indeterminate crop such as faba beans is by and large undetermined.

Leonard (1962) reviewed the interrelation of vegetative and reproductive growth in indeterminate crops. He addressed the problem of yield development in determinate versus indeterminate and made the point that in determinate plants, each growth stage (e.g. floral primordia initiation, pollination, and fertilization, etc.) is relatively short, and markedly different environmental conditions in each favour maximum final yield. For indeterminate plants, these growth stages are extended in time, and are subjected to the further complication of ontogenetic trends within the plant (Leonard 1962). Obviously, the indeterminate habit adds a new dimension in yield assessment beyond those techniques designed for crops of the determinate habit.

Schapaugh and Wilcox (1980) examined HI in determinate, semi-determinate, and indeterminate soybean (Glycine max (L.) Merr.) strains. They did not question the advisability of transferring the HI concept to the non-determinate growth habit types. However, they did conclude that within a maturity grouping, there was no relationship between HI and growth habit.

Harvest Index Genetics.

Plant breeding efforts which seek to influence HI (or for that matter, any trait), require a basic knowledge of the range of existing variability, and also the number of genes and gene action involved. Selection is most effective when a small number of genes are involved (Gamble 1962), and less effective for polygenically controlled traits (Shebeski and Evans 1973).

In the case of HI, however, the genetic information is extremely scant, despite the apparent fundamental role of this concept. Roseille and Frey (1975) reported broad sense heritability estimates of between 0.47 and 0.90 for HI in oats. Bhatt (1976) studied HI inheritance in eight wheat cultivars. A wide range of variability for HI was reported; as well, broad sense heritability estimates ranging from 0.48 to 0.88 (mean=0.70) were reported. The gene action was found to be largely additive with a minimum gene number ranging from 0.68 to 3.17 (Bhatt 1976)

In V. faba, only one study of the genetics of HI has been reported. De Vries (1979) indicated a broad sense heritability estimate of between 0.40 and 0.70 for HI in faba beans. This author concluded that HI offered no prospects as a yield breeding criterion in this crop.

Dry Matter Accumulation. Total dry matter accumulation provides an integrated account of the "ability of a genotype to exploit its environment" (Donald and Hamblin 1976). The total dry matter accumulation of a genotype is the yield value when the genotype is grown for forage purposes while total dry matter production provides a basis for seed yield as determined by HI in genotypes grown for seed yield. A natural starting point for examining yield related trait interrelationships in faba beans is thus dry matter accumulation. However, the literature is rather scant in the area of faba bean dry matter accumulation.

Ishag (1973) studied dry matter production in faba beans using growth analysis techniques. The results obtained, based on four cultivars under British conditions, indicated the maximum reproductive growth rate did not coincide with the most favourable photosynthetic conditions (i.e. light, temperature, leaf area index). It was suggested that in order to obtain maximum yield, two physiological criteria would have to be met: (1) the need for a large leaf area duration prior to flowering, and (ii) the need for a large leaf area at podding.

Thompson (1979) obtained results that would seem to concur with those of Ishaq (1973). The growth of a spring faba bean under luxuriant conditions (only light, temperature, or CO2 limiting) was compared to growth under control conditions (corresponding to normal agronomic practice). It was discovered that there was a marked increase in dry matter production under luxuriant conditions attributable largely to an increased leaf area index (8.0 versus 5.0), and increased leaf area duration (514 versus 309 LAI days). The increase in dry matter production, however, was accompanied by a decrease in HI so that seed yield remained largely unchanged. The outcome of these experiments led Thompson (1979) to conclude that research efforts to improve the photosynthetic eficiency, at least for the cultivar Herz Freya, would not likely be as rewarding as research aimed at improving assimilate partitioning. Thompson and Taylor (1981) reported similar results from the continuation of these experiments over the next years.

Gehriger *et al*. (1979) presented somewhat conflicting results. In examining the influence of decapitation on faba bean yield, they found that HI was extremely stable over the three decapitation treatments and control plants. These authors concluded from this result that it was the biological mass (i.e. dry matter accumulation) that actually limited grain yield.

It is obvious that the physiological interrelationships of dry matter production, HI, and yield procurement in faba beans require further elucidation.

MATERIALS AND METHODS

Accession Characterization

Seed source.

Seed was obtained from the University of Manitoba faba bean germplasm collection in which each strain was accessioned and designated as one in the series 2N1 through 2N535. This collection of accessions draws from a world wide base, and includes entries of European cultivars, ICARDA (International Centre for Agricultural Research in the Dry Areas) strains, and strains of Middle Eastern origin. It includes both spring and winter types, and major, minor, equina and paucijuga sub-species.

Planting pattern.

In the spring of 1980, seed of these 535 accessions was planted. Where seed size permitted, a cone seeder pulled behind a tractor was used; if seeds were too large for mechanical planting, they were hand planted. Each accession was represented by approximately 20 seeds planted in a three meter row. Rows (i.e. accessions) were spaced on 60 cm centers, and path ways were 1m in width. Two guard rows of the cultivar Herz Freya were planted at either end of the accession block. Accession lines were not randomized over the block, but arranged in order with 2N 1 planted in the north-east corner. The resulting planting pattern is illustated in Figure 1.

The spring of 1980 was early, by Manitoba standards, with the result that seeding was completed in two days by April 28, 1980. Soil moisture and post-planting precipitation were far below normal, however, and many lines failed to germinate until irrigation was applied in June.

For 1981, the planting pattern was exactly the same as it was in 1980 with the exception that 40 new accessions (2N536-2N576) were added.

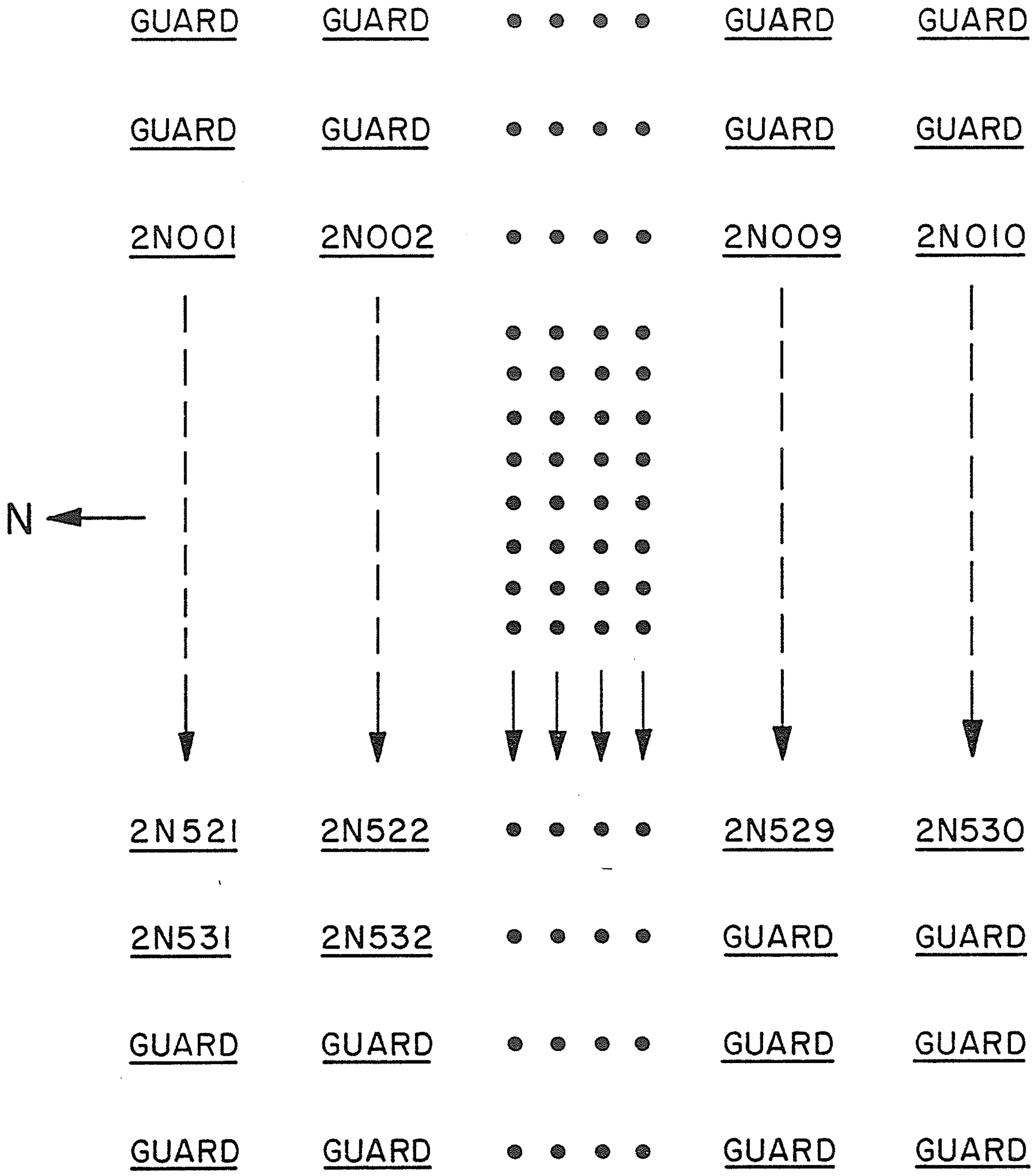

FIGURE 2. Planting pattern of accession lines, 1980 and 1981

Again the spring was early, and seeding was completed by April 26, 1981. Soil moisture was much better than 1980, and allowed for more even and earlier germination. Once again, though, post-planting precipitation was minimal. Irrigation was applied May 20, 1981, and then adequate natural precipitation followed. Accession 2N 1 was again placed in the northeast corner, so that for each line, solar orientation was identical for both years.

Data Collection.

During the growing seasons, each line was observed and data collected for the line as a whole for two characteristics:

i) Days from planting to emergence (EMERG).

ii) Days from emergence to first-flower (FLOWER).

The majority of the data collection took place at harvest time. The source of replication was single plants, with three per accession line characterized individually. As much as possible, the three plants chosen were disease free, and representative of the accession line in general. At harvest, the following measurements were taken on each single plant.

iii) number of pods per plant (PODS).

iv) plant height in centimeters (HEIGHT).

v) days from planting to maturity (MATURITY).

vi) number of podded nodes per plant (NODES).

vii) number of stalks per plant (STALKS).

Each plant was cut at ground level, then bagged and tagged, and taken indoors to dry. When the plant dried down to approximately 8-10% moisture, it was then ready for threshing. At threshing, the following information was obtained for each plant:

viii) total weight of seeds and plant material in grams (TDM).

ix) total weight of seeds only in grams (YIELD).

x) total number of seeds (SEEDS).

With all the above information at hand, it was than a simple matter to derive the final set of variables:

xi) number of seeds per pod (SEEDS/POD).

xii) number of pods per podded node (PPNODE).

xiii) 1,000 seed weight (MKWT).

xiv) harvest index (HI).

The accession material was grown on Red River clay soil, and except for irrigation to initiate germination, received only natural precipitation in both years. In 1980, precipitation over the growing season was 230 mm. In 1981, precipitation was 330 mm. Fertility levels were not tested, but considered adequate and so no additional fertilizer was added. Seeds were inoculated with *Rhizobium leguminosarum* bacteria at the time of planting.

Cross Breeding Program

Selection of Parents. Parents for six crosses were selected using the accession performance data that was collected during the first summer (1980). The accessions were first divided into *major* and *minor* sub-divisions.

The parents were selected from each group on the basis of their performance relative to the total accession population for two yield related traits:

i) Total dry matter production plant (TDM).

ii) Harvest index (HI).

The two traits, TDM and HI were examined simultaneously in order that plants good for both characteristics, good for one and poor for the other, and poor for both were selected. In addition, consideration was given to the 1980 performance rating for disease resistance, lodging resistance and general uniformity.

No reciprocal crosses were performed. Wherever possible the *minor* type was used as the female parent to maximize seed set (Omar and Hawtin 1980).

Planting procedure indoors.

Seed from a single plant of each selected accession was used for parental material in the growth chamber. For each cross, 12 female parents and eight male parents were planted in three successive plantings spaced a week apart. Seeds were scarified prior to planting, and then placed one seed per pot in 13 cm diameter clay pots. The soil mixture was a 1:1:1 mixture of loam, sand and peat fertilized with 11-48-0. *Rhizobium leguminosarum* inoculum was applied to the soil surface of each pot after planting, and watered in.

Growing conditions.

Seeds germinated, and continued to grow under growth chamber conditions of 22 degrees Celsius day and 15 degrees Celsius night and a 16 hour day length. Relative humidity was constant at 50%. Light intensity was 400 $uEm^{-2}s^{-1}$ and gro-lux wide spectrum flourescent tubes were used.

Crossing procedure.

Female parent plants were emasculated prior to pollen maturity. In the emasculation procedure, the keel petal, anthers and stamens were removed completely. Pollen from the male parent was placed on the stigma, the flower remnants closed again and the cross identified. A maximum of three flowers per node were emasculated and pollinated.

Both male and female parents were manually tripped to ensure self-pollination where desired. Some plants were "topped" in an attempt to increase seed set in lower pods. At the pod set stage all plants received supplementary nutrients in the form of water soluble 20-20-20 fertilizer.

Crossed and selfed seed was separately harvested at maturity.

F1 Hybrid Yield Evaluation, Plot Density.

The material from the cross breeding program was evaluated for yield in a field trial during the following summer. For each cross, there were five different genotypes that were compared:

i) OPP1 - seed selected at random from bulked seed harvested in 1980 from the accession plot, female parent.

ii) INBP1 - seed obtained from selfed parents in crossing program, female parent.

iii) F1 HYBRID - seed obtained from crossing program.

iv) INBP2 - seed obtained from selfed parents in crossing program, male parent.

v) OPP2 - seed selected at random from bulked seed harvested in 1980 from the accession plot, male parent.

All six crosses were represented in a split-plot experimental design. The six crosses made up the main plots, and the five genotypes per cross represented the sub-plots. The experiment contained three replicates with genotypes randomized within crosses.

Each genotype or sub-plot consisted of a single row, 1.5m in length, planted at a density of 25 seeds per row. With rows on 30 cm centers, this simulated commercial planting densities. Guard rows of the cultivar Diana were planted at each end.

Seed rows were opened using a mechanical seeder, but seeds were planted by hand. Rhizobium leguminosarum inoculum was applied at this time. In all other respects, the growing conditions were identical to those of the accession material.

Plots were cut at ground level, and stooked at maturity. Following a drying period of approximately 10 days, the plant material from each plot was weighed to determine TDM. Following this it was threshed, and the seed alone weighed to determine yield.

F1 Yield Component Analysis, Spaced Plants.

In addition to the yield trial, the material from the crossing program also went to the field in a yield component analysis experiment. In this case, for each cross, three genotypes were compared:

i) IBP1 - seed obtained from selfed parent in crossing program, female parent.

ii) F1 HYBRID - seed obtained from crossing program.

iii) IBP2 - seed obtained from selfed parent in crossing program, male parent.

Again, all crosses were represented in a split plot experimental design in which the six crosses made up the main plots, and the three genotypes per cross made up the sub-plots. This experiment contained two replicates with crosses randomized within replicates, and genotypes randomized within crosses. Two guard rows of the cultivar Diana were included at either end.

Each genotype or sub-plot consisted of a single row, 2m in length, planted at a density of 12 seeds/row. On 60 cm row spacing, this was considered spaced plant density, or plant breeder's selection density.

The planting method was exactly the same as that described for the F1 yield evaluation.

At maturity, a total of five plants per plot were examined individually. Each plant was identified and handled individually in exactly the same manner as previously described for the accession material with the result that each plant was characterized for the following traits:

i) number of pods per plant (PODS).
ii) plant height in cm (HEIGHT).
iii) days from planting to maturity (MATURITY).
iv) number of podded nodes per plant (NODES).
v) number of stalks per plant (STALKS).
vi) number of nodes to first pod (NNFP).
vii) total weight of seeds and plant material (TDM).
viii) total weight of seeds only (YIELD).
ix) total number of seeds (SEEDS).
x) number of seeds per pod (SEEDS/POD).
xi) number of pods per podded node (PPNODE).

xii) 1,000 seed weight (MKWT).

xiii) harvest index (HI).

Statistical Analysis

Accession characterization.

Data collected on the 535 accession lines in 1980 and 1981 was first analyzed for simple statistics such as means and standard deviations (Steel and Torrie 1960). In addition, frequency distributions and simple linear regressions were calculated.

The data was also analyzed by several multivariate statistical methods. Firstly, a factor analysis was performed which invoked iterated principal axis factoring (Harman 1965) and rotation by the varimax procedure (Kaiser 1958). Secondly, discriminate analysis using the generalized squared distance model (Kendall and Stuart 1961) was employed. Multiple regression analyses were also performed, and correlation co-efficients calculated. All of these statistical techniques were carried out on the University of Manitoba computer using available SAS programs (Helwig and Council 1979).

F1 evaluation.

The data from both field experiments (plot density yield evaluation, and spaced plant analysis) was analyzed as split-plot designs. Again, the locally available SAS (Helwig and Council 1979) programs were used in computation.

RESULTS AND DISCUSSION

Accession Characterization

Introduction.

The raw data, tabulated on a per plant basis, for 1980 and 1981 is too copious for this report but Appendices A and B list mean data for each accession line for 1980 and 1981 respectively. It is obvious both from per plant data, and per line data, that total dry matter production (TDM) and yield were higher in 1980 than 1981. This result is contradictory to the general trend exhibited by experimental plots (McVetty, personal communication)[2], and commercial fields (Rogalsky, personal communication)[3]. In terms of micro-plot conditions, however, the result is not as surprising as first appearances would indicate. The spring and early summer of 1980 were extremely dry; thus, germination was sporadic, and early plant development was restricted. Conditions changed in August and September 1980 such that these two months were wet and cool, thus favouring plant development. In conjunction with these conditions, the indeterminate habit of fababeans resulted in continued flower, pod, and dry matter production well into the "normal" harvest period. Since plants were being harvested individually by hand, development was allowed to continue, until frost finally halted growth.

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[2] McVetty, P.B.E. Unpublished data

[3] Rogalsky, J. Manitoba Department of Agriculture, unpublished data.

The 1981 growing season began much the same way as 1980. However, precipitation followed much closer after seeding. During, June and July, temperatures were moderate and moisture supply was more than adequate; these conditions were very favourable to fababean growth. In August, conditions turned dry. As well, very severe winds during a summer storm whipped plants around and substantially damaged many stems. In combination with the moisture stress, these conditions halted plant growth completely and resulted in maturation of all lines simultaneously. In comparison to the 1980 season, there was less time for dry matter production, the flowering period was much shorter, but most importantly, grain filling was abruptly ended at an early stage.

The mean values, for each characteristic, over the entire accession population are presented in Table 1. Both years are represented to allow for direct comparison.

As is shown in Table 1, the emergence was faster and more uniform in 1981 than in 1980. This reflected the difference in soil moisture at planting time between the two years. The number of days from emergence to first flower was virtually equal in both years.

The number of days to maturity was much longer in 1980 compared to 1981, and once again reflected climatic differences between the years. Yield and TDM were approximately twice as high in 1980 versus 1981 for reasons previously discussed. HI was slightly lower in 1981. Mean plant height in 1981 was higher than in 1980. It seems natural to assume a positive correlation between TDM and height, and on this basis one would expect that the 1980 mean plant height would be greater than that for 1981. In fact the reverse is true, which leads to a re-examination of the assumption. On closer examination, the assumption that

TABLE 1

Comparison of 1980 and 1981 population means

Characteristic	Year 1980		1981	
	Mean	S.E.	Mean	S.E.
EMERG (days)	33.75	0.27	24.24	0.13
FLOWER (days)	29.08	0.10	30.30	0.14
SEEDS/POD	2.60	0.02	2.62	0.02
SEEDS	73.47	1.09	52.09	0.67
PODS	28.29	0.37	19.60	0.23
HEIGHT (cm)	79.73	0.45	92.60	0.42
MATURITY (days)	135.70	0.33	108.46	0.19
YIELD (g)	51.97	0.65	24.14	0.30
TDM (g)	103.49	1.20	50.57	0.49
STALKS	4.34	0.06	3.73	0.05
NODES	19.47	0.24	11.68	0.12
PPNODE	1.46	0.01	1.68	0.01
MKWT (g)	840.52	9.44	535.26	7.37
HI (%)	50.89	0.37	46.34	0.37

plant height and TDM are positively correlated is correct (see Table 8). However, it seems that the assumption is valid within seasons only, not between seasons.

As expected, the mean value for the primary yield component, pod number per plant, followed basically the same trend as yield, being higher in 1980. The number of seeds per plant, and number of podded nodes followed a similar pattern. The value for seed number per pod was exactly the same in both years. Pod number per podded node was slightly higher in 1981. This is perhaps an indicator of slightly more favourable conditions at anthesis in 1981, but is certainly not conclusive evidence. Mean seed weight was higher in 1980, but in both years showed a high degree of variability. The premature maturation caused by the stem breakage in the wind storm most probably influenced these results and caused the poorer 1981 performance.

Frequency Distributions.

TDM, yield and HI. It is obvious from the previous discussion that, based at least on most absolute parameters, the accession population as a whole was significantly less productive in 1981 compared to 1980. An examination of frequency distributions for some of the characteristics will reveal whether or not within each year the populations acted similarly over their given range of variability.

The TDM frequency distributions are given in Figure 3. Both distributions appear fairly normal with the exception of a tendency to be skewed left, in that there was a rapid rise to the maximum frequency level. After the maximum peak was reached, the decline in frequency was much less rapid. The 1981 distribution was slightly more compact around

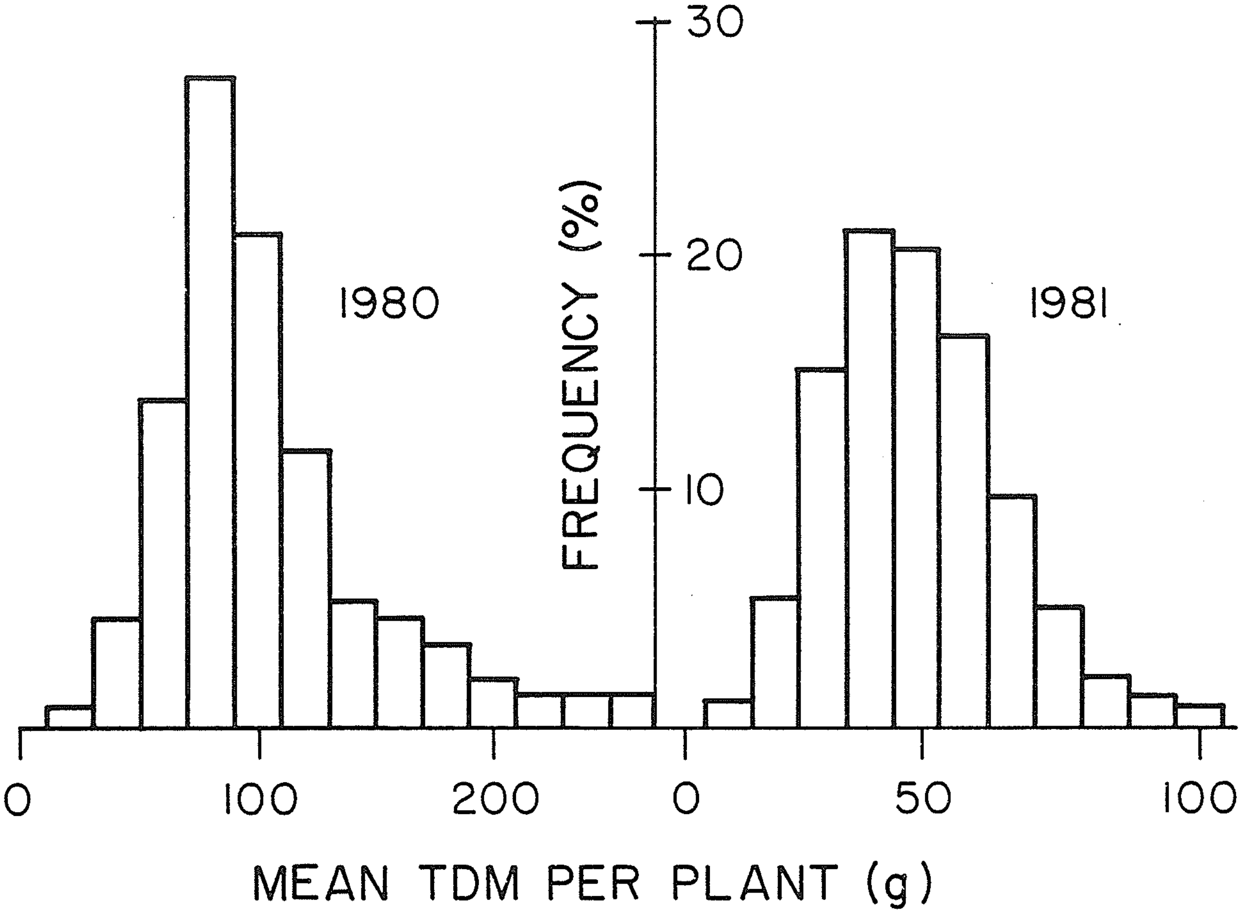

FIGURE 3. Frequency distributions of TDM in 1980 and 1981 accession populations.

the mean in comparison to the 1980 distribution. However, in both cases, the interval defined by twice the standard deviation on either side of the mean (X + 2 S.D.) contained over 97% of the accession strains. The range in mean TDM per plant for 1980 was from less than 20 g to over 260 g; for 1981 the corresponding range was 10g to 120 g per plant.

The frequency distributions for yield are shown in Figure 4. The distributions depicted similar trends to the TDM distributions, in that they were both skewed slightly left of normal again. It appeared, however, that for yield the skewness was not nearly as severe. The rise was slower to the left of maximum frequency in comparison to the TDM distributions. For both yield curves, though, the rise to maximum frequency was faster than the decline from maximum. Once again, the yield distribution for 1981 appeared slightly more compact than did the 1980 distribution. In both cases, the interval defined by twice the standard deviation on either side of the mean (X + 2 S.D.) contained over 96% of the accession lines. Mean yield per plant ranged between 0g and 130g in 1980, and between 0g and 70g in 1981.

As a unitless ratio, HI by definition can only take values between 0% and 100%. This allowed for a direct comparison between seasons without the influence of actual yield or TDM values. Figure 5 illustrates the frequency distributions of HI over both seasons. In both years, there were no HI values in excess of 75-80%. Both distribution curves rose slowly to a peak between 45-55%, and then dropped rapidly beyond that point. This resulted in the curves appearing to be skewed to the right of normal. The HI curve for 1980 showed a distinct peak at 55%, whereas

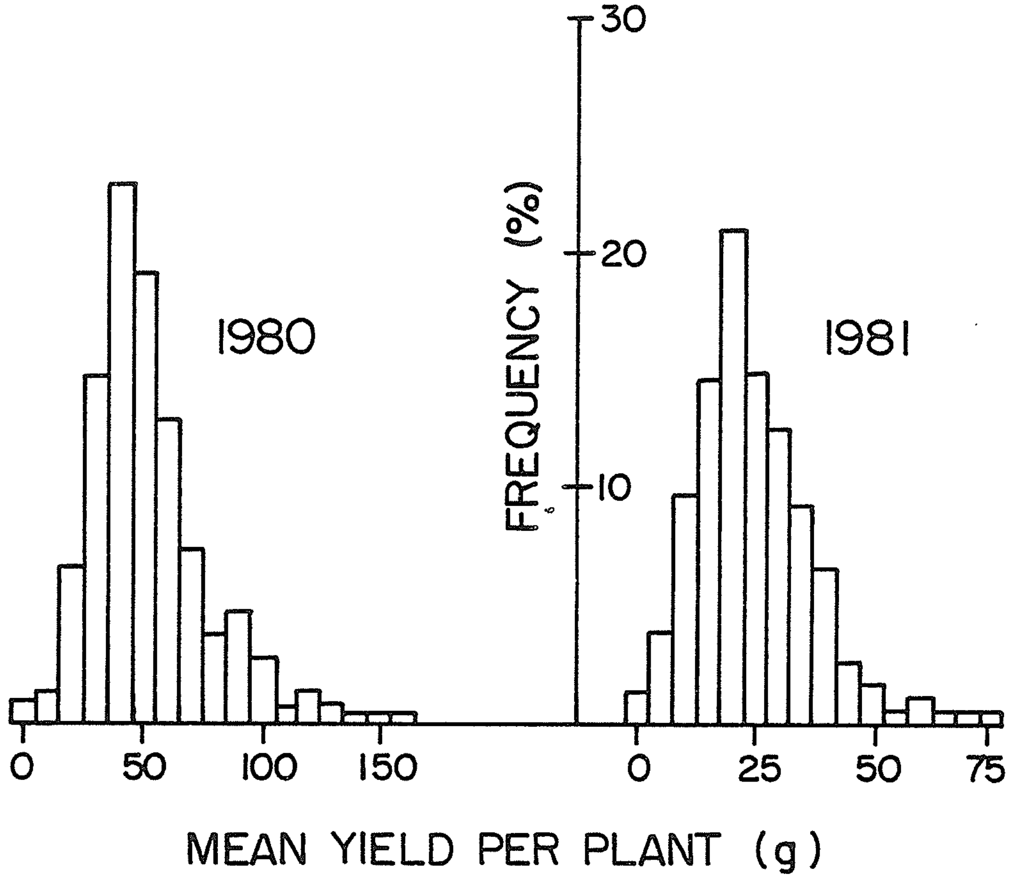

FIGURE 4. Frequency distributions of yield in 1980 and 1981 accession populations.

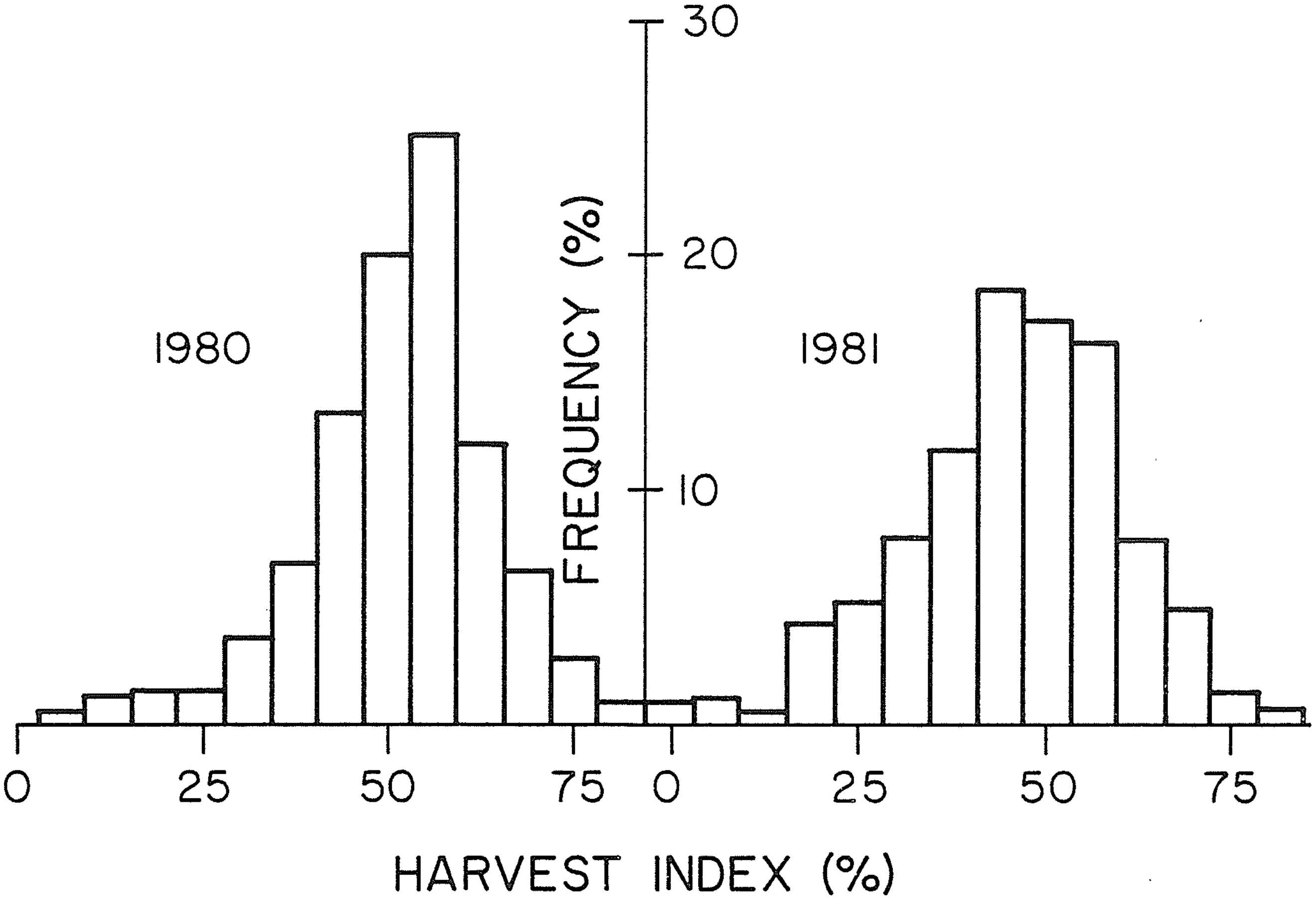

FIGURE 5. Frequency distributions of HI in 1980 and 1981 accession populations.

the peak for 1981 was less distinct and ranged between 45% and 55%. Mean HI values ranged from 0% to approximately 75% in both years.

Yield components. The frequency distributions for pod number per plant are shown in Figure 6. In a pattern similar to the yield curve, they showed a tendency to skew to the left. The range in pod number per plant was 0 to 90 pods in 1980, and 0 to 60 in 1981.

For seed number per pod, the distributions were almost identical (see Figure 7). Not only were the means equivalent as earlier discussed, but the range of this character was practically identical in both years. The observed range in variability for mean number of seeds per pod was from 0.8 through 4.0. The distributions themselves were very similar from year to year in that both approximate a normal distribution.

The frequency distribution for 1000 seed weight (MKWT) exhibited by the accessions is shown in Figure 8. The 1980 frequency distribution is unique from all the previous distributions in possessing an apparent second peak. The curve showed the major frequency peak at a 1000 seed weight value of around 700g, and a secondary peak, less distinct, in the range of 1100 - 1200g. This secondary peak was attributable to those lines of the major type which are by definition higher in seed size (and hence, seed weight). The peak was of a much lower total height because the University of Manitoba accession collection is comprised, in large part, of minor types, with major types having less representation. On examining the 1981 distribution for seed weight, however, the secondary peak is not apparent. There is a slight levelling of the downward slope of the curve at about 800g, but this could be as easily attributed to statistical deviation as it could be to a significant effect. The

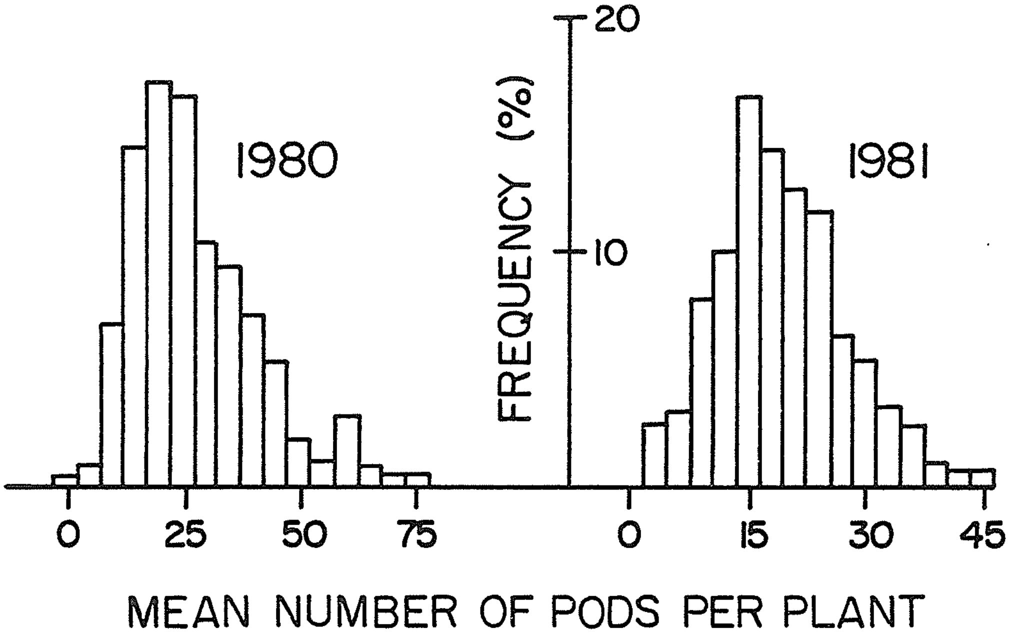

FIGURE 6. Frequency distributions of pod number per plant for 1980 and 1981 accession populations.

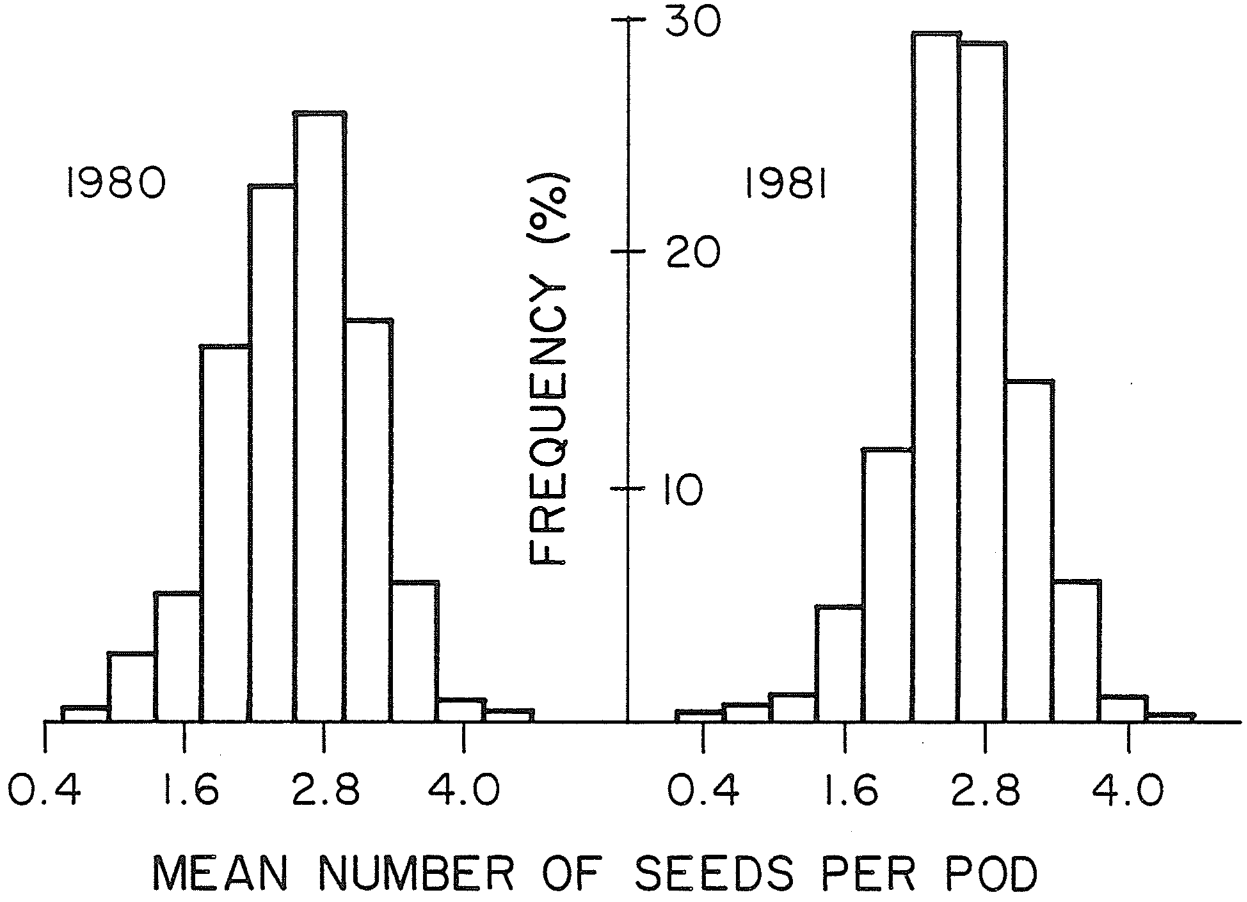

FIGURE 7. Frequency distributions of seed number per pod for 1980 and 1981 accession populations.

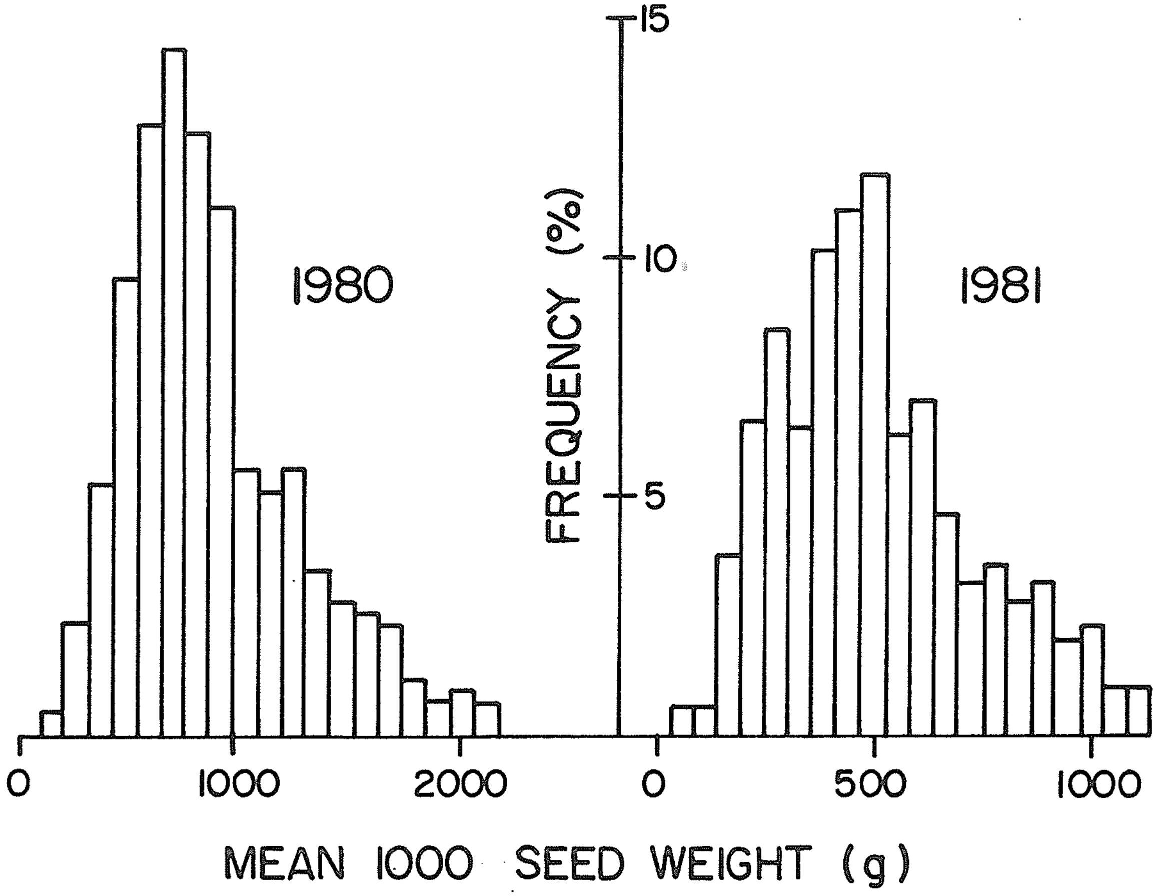

FIGURE 8. Frequency distributions of seed weight for 1980 and 1981 accession populations.

unique two-peak distribution of 1980 is not reproduced in 1981. It is felt that the unnatural maturation conditions in 1981 halted grain filling and so severely restricted the expression of seed weight, especialy in the larger seed weight types. Seed weight exhibited a wide range of variability in both years. Values for 1980 ranged from less than 250g per 1,000 seeds to greater than 2,000g. In 1981, the range was not as great (from 200g to 1500 g), and another indication of the effects of the abnormal arrest in grain filling.

Simple Linear Regressions.

A further step in the characterization of the accession population was to investigate the extent to which it could be considered as a composite of minor and major sub-populations.

The minor subspecies is characterized as an erect plant, with low tiller number and producing small, round seeds possessing a 1,000 seed weight less than 800g (Cubero 1974). The major subspecies, in contrast, is characterized by a shorter, bushier plant type, producing large, flat seeds with a 1,000 seed weight in excess of 1200g (Cubero 1974).

The frequency distributions indicated that there was obviously no distinct division between major and minor accessions based solely on seed weight or height. Rather, a continuum existed from minor types, through equina, to major and any division between sub-species based on seed weight would be strictly arbitrary and highly subjective.

It was felt, though, that one should test whether in fact genotypes of higher seed weight were in fact shorter; or for that matter, if any simple trends could be detected defining relationships between seed weight and various yield components. Table 2 summarizes these simple linear regression analyses. Seed weight was regressed on height, pod number per plant, seed number per plant, seed number per pod, stalks, number of podded nodes, pod number per podded node, yield and TDM respectively. The resultant F-ratios are listed.

It is obvious from Table 2, that there was a very strong relationship between seed weight and height (p=.001). The estimated slope of the regression line was negative in both years which indicated that increasing seed weight was associated with decreasing plant height, as expected. A similar relationship existed for the yield components: in both years, F-ratios were highly significant (p = .001), and slope estimates were negative and of the same order of magnitude in both years.

A variable which showed a positive association with seed weight was the number of stalks per plant. In 1980 the regression was significant (p=.05), and in 1981 it was highly significant (p=.001). Slope estimates were 11.56 and 27.94 respectively. Again, this is an expected result since <u>major</u> subspecies are characterized by a bushier plant type.

With regard to the two yield parameters, yield and TDM, there was again a positive association with seed size. This indicated that higher yield was associated with increased seed size,

especially in the intermediate seed weight range. It would be premature to suggest selection for higher yield based on seed weight alone, however, since adequate representation of heavier seed weight genotypes is lacking. In addition, mechanical harvest techniques, which lend themselves to smaller seed type, must also be kept in mind.

TABLE 2

F-ratios and slope estimates for seed weight regressed on various yield components (1980 and 1981)

Dependent variable: 1,000 seed weight				
	1980		1981	
regressed on	b	F-ratio	b	F-ratio
HEIGHT	-6.32	52.34***	-3.99	26.55***
PODS	-10.97	114.10***	-13.28	101.43***
SEEDS	4.43	178.10***	- 4.61	105.37***
SEEDS/POD	-178.95	57.94***	-86.62	15.73***
STALKS	11.56	3.16*	27.94	18.55***
NODES	-13.23	65.18***	-15.83	32.69***
PPNODE	-452.39	64.43***	-335.45	138.97***
YIELD	2.64	16.93***	4.78	20.07***
TDM	1.45	17.68***	1.47	4.86**

* significant at p=.05

** significant at p=.01

*** significant at p=.001

Rank Correlation.

As a further investigation of the similarities and differences between the 1980 results, and those of 1981, a rank correlation analysis was performed. The first step in this analysis was to rank each accession in order for each of its TDM, yield, and HI values in 1980. The same procedure was then applied to the 1981 data. With each strain ranked within each year, the correlation between 1980 rank and 1981 rank was determined. The summary rank correlation matrix is given in Table 3.

The correlation co-efficients on the diagonal are of prime interest in this analysis, since they furnish information regarding the same variable over both years.

The rank correlation showed a very high positive correlation (r=0.999, significant at p=.001) between TDM rank in 1980 and TDM rank in 1981. This was noteworthy since it indicated that relative to each other, the strains performed very similarly in TDM production over both seasons.

A similar situation existed for the rank correlation for yield. There was a highly significant (p=.001) positive association (r=0.682) between yield rank in 1980 and yield rank in 1981. Though not as strong an association as for TDM, the rank correlation for yield again indicated that relative to each other, the strains performed similarly in both years.

The rank correlation for HI was non-significant, thus indicating no relationship between 1980 rank and 1981 rank for this parameter. This result could arise for several reasons. Firstly, HI is a derived

TABLE 3

Rank-correlation summary for TDM, yield and HI in 1980 and 1981 accession populations

	TDM 81	HI 81	YIELD 81
TDM 80	0.999***	0.143	0.842***
HI 80	-0.142	-0.027	-0.118
YIELD 80	0.807***	0.105	0.682***

***Significant at p=.001

variable from yield and TDM, and therefore suffered since there were now two sources of variability impinging on its calculation. This could result in excessive variability masking an underlying relationship. The second explanation, is that there simply was no relationship between HI values from year to year, indicating a lack of genetic control over this trait.

In summary, the rank correlation analysis showed a very strong association between 1980 and 1981 rankings for yield and TDM, but not for HI. This meant that, relative to each other, the various genotypes (accession lines) behaved similarly over both years. Despite environmental differences between the years which caused absolute differences between 1980 and 1981 performance, the genetic components which determined yield and TDM played major roles. The nature of the genotype X environment interaction was consistent over both years, but the magnitude changed considerably.

Discriminate Analysis.

As opposed to cluster analysis which seeks to uncover "natural" sub-groupings within a population, discriminate analysis begins with an a priori assumption of 2 or more sub-populations (Svab and Janossy 1971; Singh and Chaudhary 1979). A discriminate function of the following form is then calculated:

$$Z = b_1X_1 + b_2X_2 \; . \; . \; . \; . \; . \; . \; . \; . \; . \; b_nX_n$$

where X_i = variables measured

b_i = regression co-efficient

This function is calculated based on Z values such that the ratio

$$\frac{\text{variance between groups}}{\text{variance within groups}} \quad \text{is maximized}$$

The measure of effectiveness of a given discriminate function is the number or percentage of individuals misclassified (that is, those cases where the function places a line in a group, different from that one which into which it is placed _a priori_).

For many of the accession strains, there was some limited information on geographic region of origin (or at least, the source from which the strain was obtained). This geographic "origin" data was used as the _a prori_ classification criterion to place strains into one of three groups: Western Europe (designated as UK), Eastern Europe (designated as CZECH), and Middle East (designated as EGYPT). Discriminate analysis was then performed using the appropriate SAS computer program (Helwig and Council 1979).

A discriminate function was calculated for each year; the co-efficients of the linear functions are given in Tables 4 and 5.

On the basis of these functions, strains were then classified as belonging to one of the three groups. Where the function caused a strain to be classified into a group other than that group to which it was originally assigned, a misclassification resulted. For a complete list of misclassified strains in each year, consult Appendix C. A

TABLE 4

Linear co-efficients from 1980 discriminate analysis

VARIABLE	Group CZECH	 EQYPT	 UK
CONSTANT	-306.652	-299.093	-311.497
EMERG	-0.123	-0.078	-0.124
FLOWER	1.313	1.329	1.371
SEEDS	-0.463	-0.441	-0.452
PODS	-2.623	-2.612	-2.618
HEIGHT	0.429	0.289	0.389
MATURITY	0.798	0.797	0.822
YIELD	-1.638	-1.687	-1.660
TDM	0.546	0.563	0.551
NODES	7.210	7.046	7.099
STALKS	0.523	0.921	0.726
HI	1.427	1.450	1.433
SEEDS/POD	25.210	24.245	25.323
PPNODE	99.107	101.434	100.208
MKWT	0.046	0.047	0.047

TABLE 5

Linear co-efficients from 1981 discriminate analysis

VARIABLE	Group CZECH	 EQYPT	 UK
CONSTANT	-1529.433	-1495.809	-1510.716
EMERG	0.789	0.683	0.790
FLOWER	0.060	-0.039	0.082
SEEDS	-1.294	-1.323	-1.291
PODS	-0.426	-0.375	-0.373
HEIGHT	1.998	1.843	1.881
MATURITY	4.707	4.608	4.638
YIELD	0.130	0.156	0.035
TDM	-0.961	-0.961	-0.907
NODES	9.124	9.061	9.056
STALKS	9.765	10.112	9.712
HI	0.044	0.051	0.042
SEEDS/POD	34.074	33.704	34.415
PPNODE	56.461	58.659	57.333
MKWT	0.044	0.045	0.045

summary of the results is given in Table 6. From this table, one can read the success of the function for a given group down the diagonal. Thus, in 1980, the function was successful in placing 67.7% of prior classified CZECH strains into the CZECH group. The corresponding figures for EGYPT and UK were 92.4% and 27.9% respectively. For 1981 the success rates were 66.3%, 86.5% and 48.5% respectively.

In terms of misclassifications, the functions were about equivalent in either year. In 1980, a total of 118 strains were misclassified, or about 26%. For 1981, the number was 121 or about 27%. This indicated that the discriminate analysis was reasonably successful in developing a criterion by which the geographic region of origin of these strains could be distinguished. Though a 27% misclassfication rate is not perfect, obviously, it is within the range of acceptability (Brewster, personal communication).4

In addition to a mere calculation of misclassification percent, it was instructive to examine more closely the nature of these misclassifications. The first observation of interest was that there appeared to be an unusually large number of strains that were misclassified in both years. That is, over both years, there was a total of 64 accession strains which were repeat misclassifications. If the misclassification process occurred at random, one would expect 31.85 lines to be repeat misclassifications. A chi-square test (Table 7), showed that the result was a highly significant deviation from what would be expected.

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[4] Brewster, J.F. Department of Statistics, University of Manitoba.

TABLE 6

Summary of the number of strains classified into each of the three groups CZECH, EGYPT and UK by the discriminate functions for 1980 and 1981 (Percents in brackets)

FROM GROUP	INTO GROUP							
	CZECH		EGYPT		UK		TOTAL	
	1980	1981	1980	1981	1980	1981	1980	1981
CZECH	69 (67.65)	69 (66.35)	13 (12.75)	12 (11.54)	20 (19.61)	23 (22.12)	102 (100)	104 (100.0)
EQYPT	12 (4.78)	17 (6.94)	232 (92.43)	212 (86.53)	7 (2.79)	16 (6.53)	251 (100)	245 (100)
UK	33 (31.73)	19 (18.45)	42 (40.38)	34 (33.01)	29 (27.88)	50 (48.54)	104 (100)	103 (100)
TOTAL	114 (24.95)	105 (23.23)	287 (62.80)	258 (57.07)	56 (12.25)	89 (19.69)	457 (100.0)	452 (100.0)

TABLE 7

Chi-square test for misclassifications

CATEGORY	EXPECTED	OBSERVED	CHI-SQUARE
Misclassified both years	(.26)(.27)(455)= 31.85	64	32.45
Misclassified 1980	(.26)(455)=118.30	118	0
Misclassified 1981	(.27)(455)=122.85	123	0
Correctly classified	[1-(60)]455=182.00	150	5.62
			38.07***

*** significant at p=.001.

The second point of note continued in the vein of misclassification errors, and dealt specifically with the type of error. That is, with three groups, there were six possible types of misclassification errors (i.e. a UK strain could be classified as CZECH or vice-versa, and so on). In spite of there being these six types of misclassification in each year, 48 out of the 62 repeat misclassifications were of exactly the same type in both years. In other words, an unusually high number of the repeat misclassifications were misclassified the same way both years.

Therefore, a significant number of strains repeated as misclassified in both years; and a significant number of those repeat lines were misclassified exactly the same way in both years. These results indicated an obvious deviation from random expectations and pointed to an underlying pattern. The indications were that in both years, the discriminate function re-classified a significant number of strains into a different grouping, and in each year the re-classification procedure was similar. This is strong evidence that the original (_a_ _priori_) grouping was at fault, and that the geographic region of origin data pertinent to these accession strains was in error (or at least, incomplete). In fact, the source information available for the University of Manitoba accession collection is scant, though no more so than any other accession collection (Witcombe 1981). In light of this lack of documentation, such results as those reported above were not surprising. It was indeed heartening, however, to observe that the discriminate analysis procedure was sufficiently powerful and repeatable to even begin questioning the accuracy of the _a_ _prori_ classification data.

Yield Component Analysis.

Introduction. The purpose of yield component analysis is to attempt to account for the variability in yield in terms of simpler quantitative variables known as yield components. Several statistical procedures have been employed in yield component analysis including, simple correlation, multiple regression, factor analysis, and path co-efficient analysis. All of these procedures were examined in this study to enable a comparison of techniques.

Simple correlation analysis. Prior to embarking into more sophisticated yield component analysis, the simple correlations between all variables were calculated. This enabled an examination of relationships between variables without the application of any statistical model.

The correlation matrices are given in Table 8.

The highest simple correlation was between TDM and yield with a value of 0.846 in 1980, and 0.877 in 1981. This result was expected since in most cases, yield makes up approximately 50% of TDM by virtue of the method which TDM was measured. Pod number per plant was also highly correlated with yield (r=0.626*** and r=0.582*** in 1980 and 1981 respectively). It was expected that pod number would also be correlated with TDM because of the high degree of association between TDM and Yield. This result was achieved, in that there was a high positive correlation between pod number and TDM (r=0.538***, and r=0.575*** in 1980 and 1981 respectively). Seed weight, plant height and seed number

TABLE 8

Correlation matrices for yield components: 1980 values above and 1981 below

	FLOW	S/POD	PODS	HT	MAT	YIELD	TDM	STALK	PPNOD	MKWT
EMERG	-.137 -.084	0.108 -.179	-.379 -.319	0.174 -.244	0.348 0.284	-.262 -.386	-.204 -.334	-.320 0.023	-.035 -.115	0.111 -.012
FLOWER		0.038 0.061	0.112 0.216	0.126 0.348	0.178 0.162	0.028 -.149	0.123 0.025	0.050 -.123	-.004 0.375	-.067 -.305
SEEDS/POD			0.024 0.137	0.327 0.376	0.094 0.002	0.162 0.347	0.073 0.309	-.270 -.341	-.050 0.093	-.323 -.176
PODS				0.202 0.266	-.185 -.032	0.626 0.582	0.538 0.575	0.376 -.010	0.323 0.516	-.431 -.414
HEIGHT					0.291 -.116	0.162 0.227	0.217 0.402	-.363 -.396	-.007 0.274	-.310 0.226
MATURITY						-.121 -.053	-.043 -.098	-.261 -.123	-.012 0.037	0.026 0.030
YIELD							0.846 0.877	0.285 0.047	0.021 0.042	0.183 0.198
TDM								0.366 0.145	-.128 0.029	0.187 0.099
STALKS									-.125 -.349	0.080 0.191
PPNODE										-.339 -.470

per pod were also positively correlated with yield but less strongly (0.15 < r < 0.35). In terms of yield components, these results were encouraging, since pod number per plant, seed weight, and seed number per pod all showed positive correlations with yield. Within this group of three yield components, however, one finds indications of yield component compensation since seed weight was negatively correlated with pod number per plant (r=-0.431*** and r=-0.414*** in 1980 and 1981 respectively), and also with seed number per pod (r=-0.323*** and r=-0.176*** in 1980 and 1981 respectively).

Another significant result was the negative correlation between yield and days to emergence (r=-0.262*** and r=-0.386*** in 1980 and 1981 respectively). This result was expected since quicker emergence (i.e. fewer days to emergence) probably indicated faster germination and root development, both of which would be important under the dry planting conditions of 1980 and 1981. Faster germination, too, could mean that the strain was better adapted to germinate and develop at lower soil temperatures which would again be beneficial under Western Canadian conditions. The absence of significant correlation between days from planting to emergence and days from emergence to flowering would also mean that on average, lines that emerged first would flower first. This would be advantageous in avoiding hot, dry conditions at anthesis which could decrease pod set and yield.

Multiple Regression.

All variables. For the purposes of this particular analysis, all characteristics were included for study including TDM, emergence, flowering, and maturity (yield related traits) which cannot be considered as real yield components, but whose influence on yield cannot be disputed. HI was not included since it is completely determined by yield and TDM; hence, its inclusion would result in a singular matrix that cannot be inverted.

As the second step in yield component analysis, the multiple regression was performed. This particular analysis used the maximum R2 criterion for inclusion or exclusion of variables. In other words, this method searched for the combination of varibles that gave the maximum R2 value, for any given number of independent variables. Consequently, as the number of independent variables allowed in the model changed, the particular variables included could well change (as contrasted with a normal stepwise multiple regression which cannot drop a variable once it has been included in the model).

The complete ANOVA tables for the multiple regressions are given in Appendix D. In the interest of brevity, a summary of these ANOVA's is presented in Tables 9 and 10.

It was observed that in both years, the variable TDM was the best predictor of yield accounting for 71.5% and 76.9% of yield variability respectively. This was not surprising when one considers that approximately half of the measured TDM is in fact seed yield, and so a close association was expected.

In 1980, the second variable to enter the model was pod number per plant. This addition raised the R2 value from 0.715 to 0.756. In 1981, the second variable to enter the model was days from emergence to first flower; its inclusion raised the R2 value from 0.769 to 0.798.

TABLE 9

Stepwise multiple regression of all characteristics on yield, for 1980 accessions (using maximum R2 criterion)

Dependent Variable: Yield, 1980

No. of Variables	Variable(s)	R2	F
1	TDM	0.715	1245.4***
2	TDM, PODS	0.756	768.0***
3	TDM, PODS, MKWT	0.798	648.6***
4	TDM, PODS, MKWT, SEEDS/POD	0.848	686.1***
5	TDM, PODS, MKWT, SEEDS/POD, FLOWER	0.853	570.7***
6	TDM, PODS, MKWT, SEEDS/POD, FLOWER, STALKS	0.857	490.2***

*** significant at p=.001.

TABLE 10

Stepwise multiple regression of all characteristics on yield, for 1981 accessions (using maximum R2 criterion)

Dependent Variable: Yield, 1981

No. of Variables	Variable(s)	R2	F
1	TDM	0.769	1635.2***
2	TDM, FLOWER	0.798	969.8***
3	TDM, MKWT, PODS	0.820	742.5***
4	TDM, MKWT, PODS, FLOWER	0.846	670.0***
5	TDM, MKWT, PODS, FLOWER, SEEDS/POD	0.870	657.7***
6	TDM, MKWT, PODS, FLOWER SEEDS/POD, HEIGHT	0.875	566.3***
7	TDM, MKWT, PODS, FLOWER, SEEDS/PODS, HEIGHT, STALKS	0.884	526.4***

*** significant at p=.001.

At the three variable level, the models were identical in both years with the variables TDM, pod number per plant and 1000 seed weight chosen. Note that this continued the natural regression stepping in 1980, but required the replacement of days to first flower by 1000 seed weight in 1981. At this level, the models accounted for 79.8% and 82.0% of the variability for 1980 and 1981, respectively.

The number of independent variables included in the model increased up to the six or seven variable level. Beyond this point, the addition of extra variables did not greatly increase R2. The models for both years were essentially equivalent in terms of variables chosen and the order in which these variables were chosen to enter. From the three variable level in 1980, the added variables in order were seed number per pod, days to first flower, and number of stalks. The corresponding variables in 1981 were days to first flower, seed number per pod, plant height, and number of stalks.

In summary, when all independent variables were eligible for entry into the model, it was found that approximately 86% to 88% of yield variability could be accounted for by six or seven variables. The regression models were exactly the same for both years at the one, three and five variable levels. TDM was the best single predictor of yield. TDM, pod number per plant and 1000 seed weight were the best three variable combination to predict yield; and TDM, pod number per plant, 1000 seed weight, seed number per pod and days from emergence to flowering were the best five variable combination.

Multiple regression: yield components. In order to compare the results of this study with published results, it was necessary to run a multiple regression on the three classical yield components: pod number per plant, seed number per pod, and seed weight (Kambal 1969). Again, the complete ANOVA tables are given in Appendix E, but Tables 11 and 12 outline the summary statistics of interest.

From these tables it can be seen that the variable entry order into the model was firstly pod number per plant, followed by seed weight and finally seed number per pod. In both years the order of entry was the same, and the order of magnitude of the variance accounted for by the model, was approximately equivalent. In all cases, the models were highly significant (p=.001).

The results of this analysis showed that 76% of the yield variability in 1980 could be explained by these three classical yield components; in 1981, that figure fell to 68%. These values were considerably lower than the 95-98% reported by Kambal (1969). However, when one considers that this examination was over a very wide range of genotypes, compared to the three cultivars studied by Kambal, the results obtained are not unexpected.

Factor analysis. Factor analysis is a multivariate statistical technique that is useful in explaining interrelationships among a given set of variables (Lee and Kaltsikes 1973). The objective of the technique is to reduce a large number of correlated variables to a small number of main factors (Walton 1972). The factor analysis performed employed the varimax rotation (Kaiser 1958); for interpretation purposes, only factor loading greater than 0.600 were considered

TABLE 11

Stepwise regression of yield on yield components, 1980

Dependent Variable: Yield, 1980

No. of Variables	Variable(s)	R2	F
1	PODS	0.394	323.5***
2	PODS, MKWT	0.646	453.3***
3	PODS, MKWT, SEEDS/POD	0.764	535.4***

*** significant at p=.001

TABLE 12

Stepwise regression of yield on yield components, 1981

Dependent Variable: Yield, 1980			
No. of Variables	Variable(s)	R2	F
1	PODS	0.339	251.7***
2	PODS, MKWT	0.572	326.8***
3	PODS, MKWT, SEEDS/POD	0.685	354.9***

*** significant at p=.001

important (Lee and Kaltsikes 1973). Yield, also, was not included in the analysis for interpretation purposes (Walton 1972; de Pace 1979).

Factor analysis divided the 12 variables into seven major groups, or factors, (Tables 13 and 14).

It can be seen from the summary Table 15 that in both years, the most important factor (FACTOR 1) contained pod number per plant, node number per plant, seed number per plant, and TDM. This was an indication that the expression of these characters was influenced by some common underlying force; it was also significant that the character make-up of Factor 1 was identical in both years, thus adding weight to its position as the most important factor. The variables loading on factor 2 through 6 were identical in both years, but the order of factoring was somewhat different. In 1980, days to emergence and days to maturity loaded on factor 2, but in 1981 they loaded on Factor 4. Pod number per podded node and seed number per pod were the next most important factors, comprising factors 3 and 4 in 1980, and factors 2 and 3 in 1981. In both years, pod number per podded node ranked ahead of seed number per pod in terms of importance. Factors 5 and 6 were seed weight and days to first flower, respectively, in 1980. In 1981, their order was opposite, but they still made up factors 5 and 6. Factor 7 was plant height in 1980, and number of stalks per plant in 1981.

The value of factor analysis is firstly that it reduced considerably the number of characteristics that one must examine; in this case reducing from 12 to 7 the number of significant variables. Factor analysis was valuable also in allowing an examination of how the variables (or characteristics) interact in each year, and hence allowed

TABLE 13

1980 Factor analysis: rotated factor pattern

	FACTOR						
Variable	1	2	3	4	5	6	7
EMERG	-0.268	0.621	-0.007	0.075	0.021	-0.252	0.129
FLOWER	0.073	0.018	-0.007	0.013	-0.011	0.570	0.028
SEEDS/POD	0.071	0.076	-0.050	0.804	-0.012	0.016	0.181
PODS	0.943	-0.177	0.234	-0.044	-0.128	0.072	0.000
HEIGHT	0.255	0.255	-0.058	0.174	-0.120	0.115	0.718
MATURITY	-0.099	0.601	0.002	0.025	0.021	0.286	0.184
TDM	0.650	-0.047	-0.111	0.095	0.532	0.126	0.059
STALKS	0.391	-0.186	-0.171	-0.221	0.039	0.069	-0.599
PPNODE	0.103	0.000	0.879	-0.043	0.157	-0.013	0.015
MKWT	-0.293	0.060	-0.224	-0.239	0.768	-0.061	-0.166
SEEDS	0.890	-0.115	0.196	0.333	-0.131	0.088	0.106
NODES	0.968	-0.173	-0.111	-0.042	-0.103	0.053	-0.016

TABLE 14

1981 Factor analysis: rotated factor pattern

	FACTOR						
Variable	1	2	3	4	5	6	7
EMERG	-0.305	-0.026	-0.125	0.529	-0.191	-0.171	0.091
FLOWER	0.053	0.175	0.012	0.087	0.696	-0.153	-0.034
SEEDS/POD	0.137	-0.003	0.853	-0.040	-0.016	0.063	-0.204
PODS	0.914	0.326	-0.013	-0.077	0.121	-0.166	-0.018
HEIGHT	0.164	0.044	0.203	-0.195	0.319	-0.078	-0.335
MATURITY	0.012	-0.002	0.024	0.662	0.177	0.053	-0.106
TDM	0.667	0.034	0.253	-0.093	-0.021	0.357	0.218
STALKS	0.088	-0.183	-0.205	-0.076	-0.040	0.089	0.766
PPNODE	0.186	0.826	-0.002	-0.021	0.246	-0.242	-0.234
MKWT	-0.216	-0.224	-0.089	-0.033	-0.193	0.717	0.096
SEEDS	0.849	0.287	0.339	-0.094	0.122	-0.162	-0.026
NODES	0.972	-0.157	0.004	-0.073	-0.020	-0.119	0.059

TABLE 15

Summary of factor loadings, 1980 and 1981

	CHARACTERS	
FACTOR	1980	1981
1	PODS, NODES, SEEDS, TDM	PODS, NODES, SEEDS, TDM
2	EMERG, MATURITY	PPNODE
3	PPNODE	SEEDS/POD
4	SEEDS/POD	MATURITY (EMERG)
5	MKWT	FLOWER
6	FLOWER	MKWT
7	HEIGHT	STALKS

a comparison between years. The results obtained were significant in that over both years, there was a constant relationship between variables as indicated by the similarities of the factor loading patterns between years; again, this was evidence of the importance of the genetically controlled variation in the accession material.

Path co-efficient analysis. Path co-efficient is a multi-variate statistical method that deals with a closed system of linearly related variables (Li 1956). The technique was first described by Wright (1921), and has been used by investigators (Dewey and Singh 1979) to assess the relative importance of yield components.

Path co-efficient analysis requires an *a priori* formulation of a causal scheme (Li 1956), whereby the basic factors (causes) and their resultant variables (effects) are completely described in a closed system. Once this system has been described, path co-efficient analysis proceeds as illustrated below.

Given a closed system where X_5 is completely determined by X_1 X_2 X_3 X_4 and R the path co-efficients are calculated by solution of the following set of equations (where r_{12}= correlation coefficient between X_1 and X_2).

$$r_{15} = P_{15} + r_{12}P_{25} + r_{13}P_{35} + r_{14}P_{45}$$

$$r_{25} = r_{12}P_{15} + P_{25} + r_{23}P_{35} + r_{24}P_{45}$$

$$r_{35} = r_{13}P_{15} + r_{23}P_{25} + P_{35} + r_{34}P_{45}$$

$$r_{45} = r_{14}P_{15} + r_{24}P_{25} + r_{34}P_{35} + P_{45}$$

$$1 = P_{X5}^2 + P_{15}^2 + P_{25}^2 + P_{35}^2 + P_{45}^2 + 2P_{15}r_{12}P_{25} + 2P_{15}r_{13}P_{35}$$

$$+ 2P_{15}r_{14}P_{45} + 2P_{25}r_{23}P_{35} + 2P_{23}r_{24}P_{45} + 2P_{35}r_{34}P_{45}$$

This can be represented diagramatically (Figure 9). Calculated in this manner, a path co-efficient is quite simply a standardized partial regression co-efficient (Li 1956).

The results of the path co-efficient analysis are presented in Figures 10 and 11. On the basis of the correlations, and also an initial multiple regression, it was decided to include the following variables in the model: pod number per plant, seed number per pod, TDM, and seed weight.

The path co-efficient analyses indicated that the character showing the highest direct influence on yield was pod number per plant in 1980, but in 1981 TDM had the greatest direct influence. The second most important direct influence come from these same two variables (pod number per plant and TDM) However, in 1980 TDM ranked second; in 1981 it was pod number per plant. Seed weight was third highest in both years, followed by seed number per pod. The residual unaccounted variability was higher in 1981 than 1980.

On the basis of simple correlation co-efficients, it appeared that seed number per pod was at least as influential on yield as seed weight, having coefficients of r=0.162 in 1980 and r=0.347 in 1981 compared with r=0.183 and r=0.198 for seed weight in 1980 and 1981, respectively (Table 8). However, the path analysis revealed that seed weight had a relatively greater direct effect on yield. This was explained by examining more closely the relationships between yield

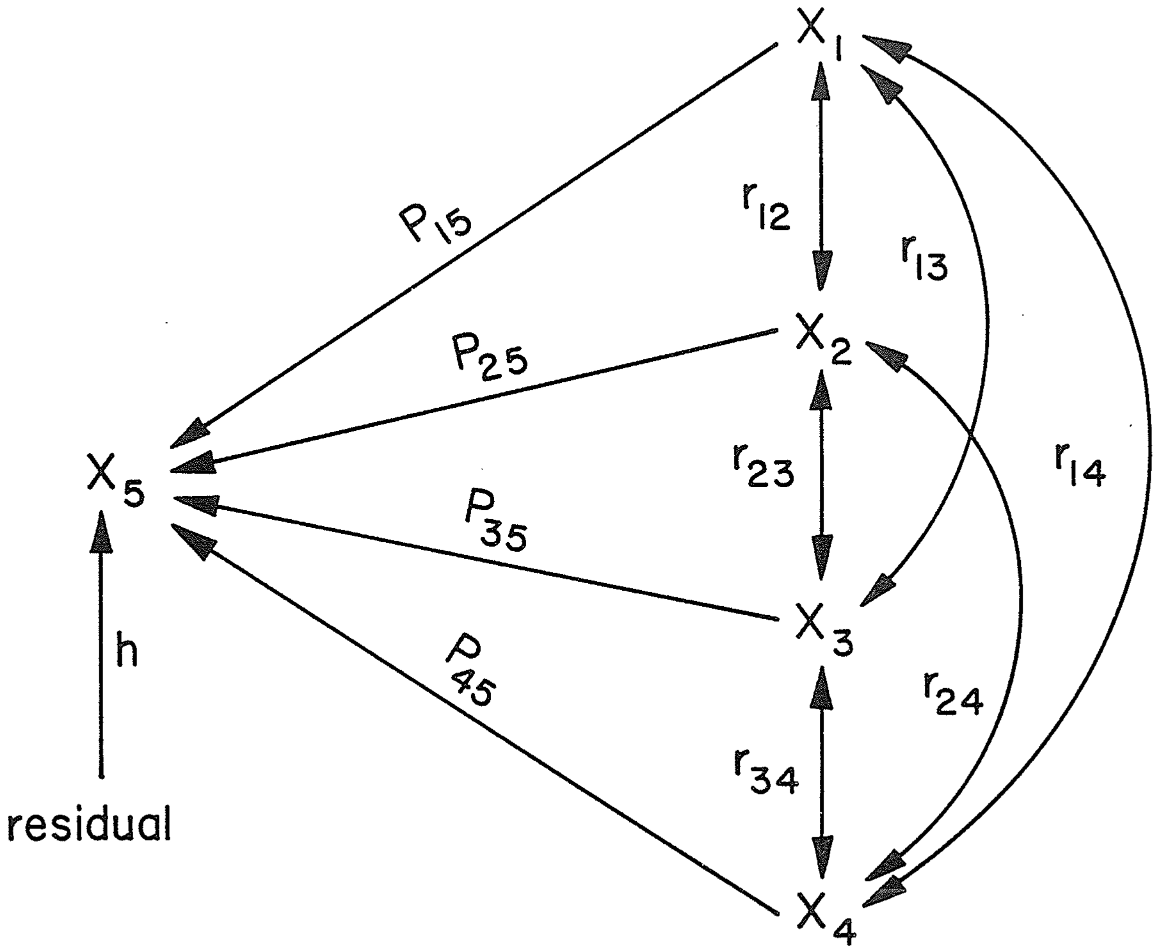

FIGURE 9. Path co-efficient model.

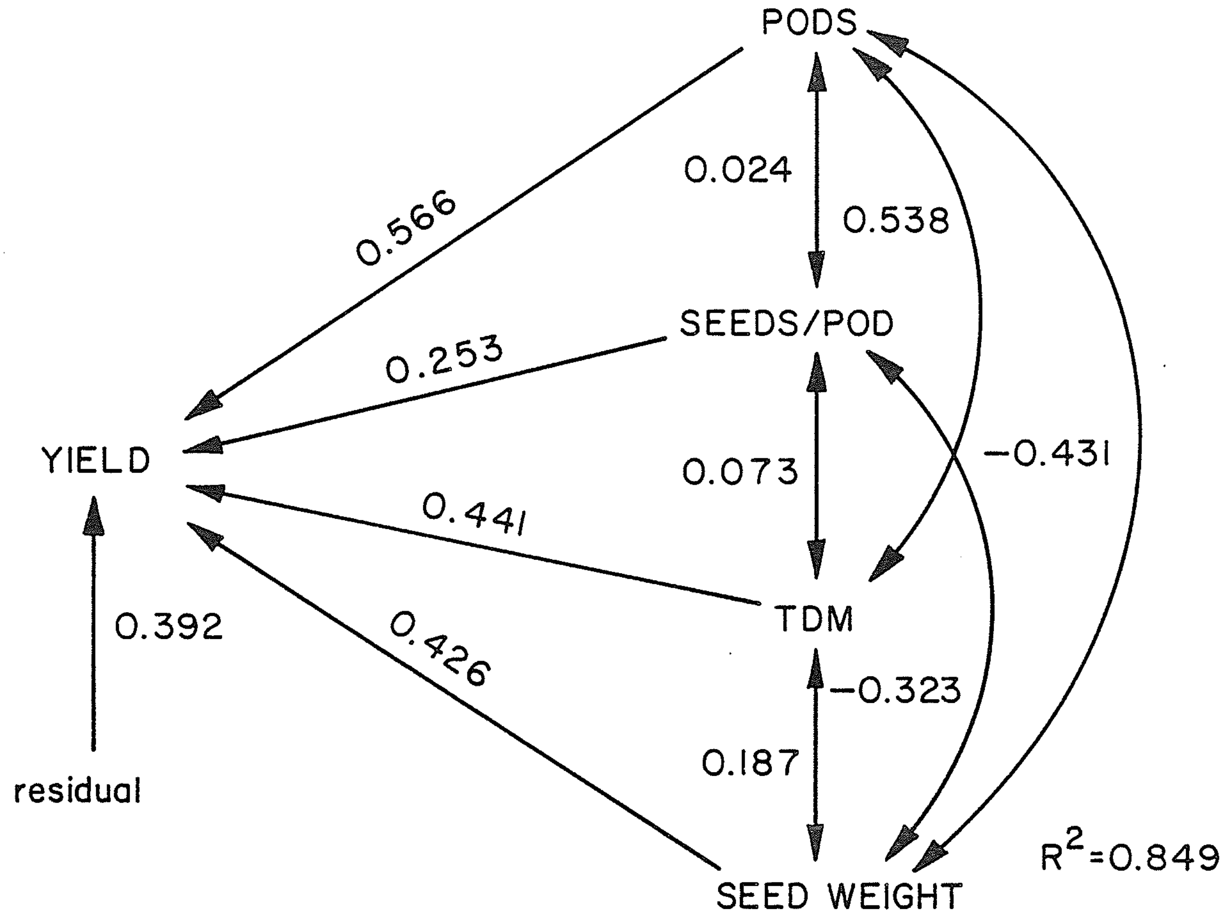

FIGURE 10. Path co-efficient analysis, 1980.

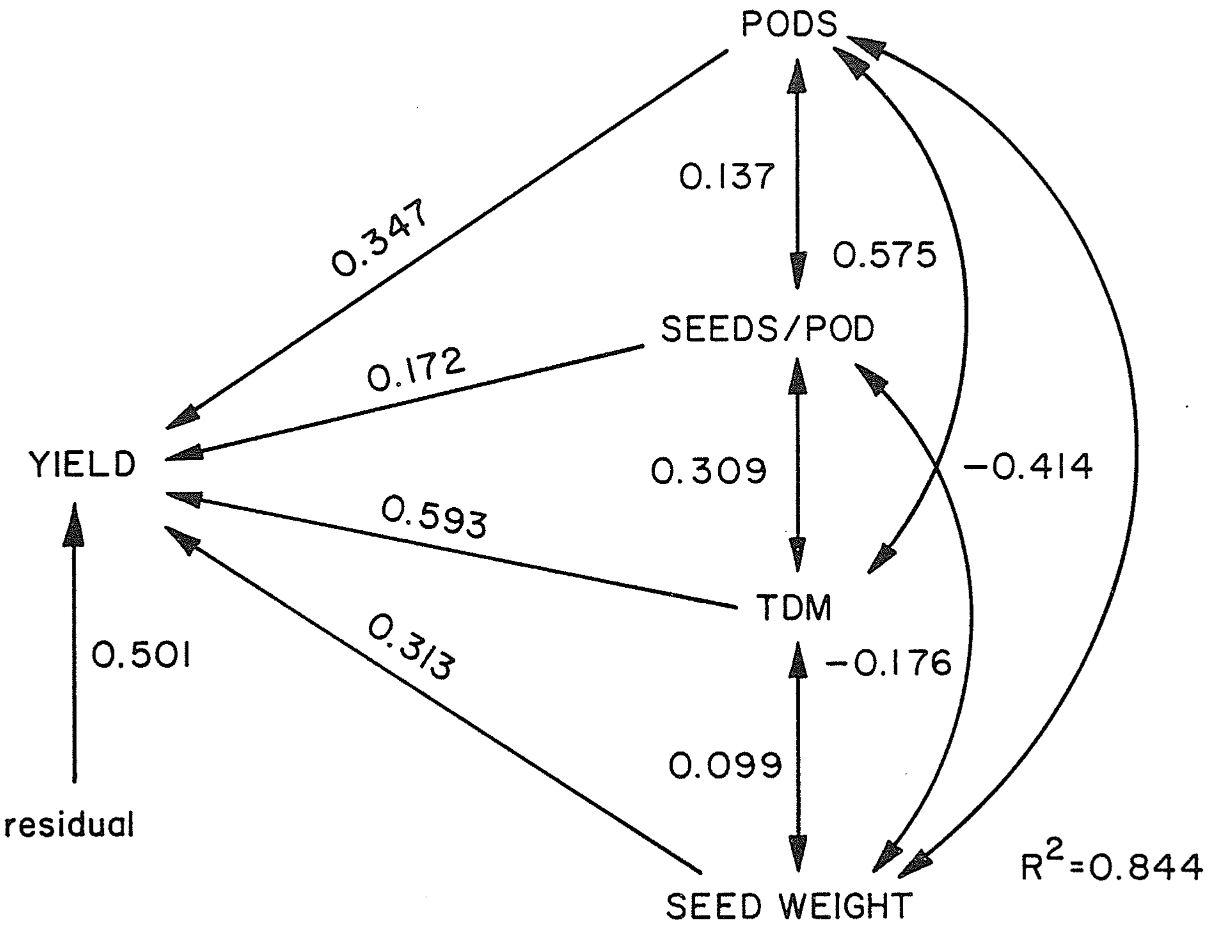

FIGURE 11. Path co-efficient analysis, 1981.

components. Seed weight was negatively correlated with both pod number and seed number per pod. Because of this, the indirect effects of seed weight on yield via pod number and seeds per pod were negative and the net correlation co-efficient between yield and seed weight (r=0.183 and r=0.198 in 1980 and 1981 respectively) was less than the direct path co-efficient (P=0.426 and P=0.313 in 1980 and 1981 respectively. However, for seed number per pod and yield, the situation was quite different, since in this case seeds per pod was positively correlated with pod number, and negatively correlated with seed weight. These indirect effects cancelled, so that the net correlation co-efficient (r=0.162 and r=0.347 in 1980 and 1981 respectively) was about equal to the direct path co-efficient (P=0.253 and P=0.172 in 1980 and 1981).

Kambal (1969) performed a similar analysis with three cultivars of *Vicia faba*. Although that analysis did not include dry matter as a variable, he was able to account for 95-98% of the yield variability by the other three variables. The results obtained in my study indicated that on the basis of the multiple correlation co-efficients, about 84% of the yield variability was accounted for by the four yield related traits. In large part, these results and those of Kambal are similar.

CROSS-BREEDING PROGRAM

Rationale Behind Crosses.

The objectives of the crossing program were two-fold. The first objective was primarily genetic in nature, and undertook to investigate whether or not one could observe F1 heterosis for any or all of the three yield parameters examined: TDM, yield, HI. If indeed heterosis existed, of what magnitude was it?

The second major objective was aimed more towards yield physiology. It involved an examination of yield structure as revealed by yield components, and also an investigation whether or not sub-species effects could be detected in crosses.

Parents were selected from the 535 accession lines, using their 1980 performance data as the selection base. From this starting point lines were placed in categories based on three criteria: relatively high or low TDM, relatively high or low HI, and *major* or *minor* sub-species. for abbreviation purposes, lines were described first by TDM (H or L), then HI (H or L), and finally by subspecies ("maj" or "min"). Thus, the six crosses made, were outlined as follows:

CROSS I	HL min X LH maj
CROSS II	HL maj X LH maj
CROSS III	HL min X LH min
CROSS IV	HH min X HH maj
CROSS V	LL min X LL maj
CROSS VI	LH min X HL maj

To produce high yield, both high TDM and high HI must coincide; neither one alone is sufficient. In light of this, all crosses attemped to combine TDM and HI in various combinations with a view to examining their role in yield determination in the F1 hybrid.

Each cross will be detailed individually to allow for a description of firstly the rationale, and secondly the parents chosen.

The rationale behind Cross I was to match high TDM and high HI across sub-species. In this case, the high TDM parent was a minor sub-species; the high HI parent was from the <u>major</u> group. The parents selected were 2N535 and 2N268. Their 1980 performance data follows:

	2N535			(minor)		2N268			(major)
TDM	39.93g	SE	=	0.75g	TDM	18.65g	SE	=	3.18g
HI	47.8%	SE	=	1.0%	HI	64.8%	SE	=	0.9%

There was a significant difference between the two lines for both TDM and HI.

For Cross VI the rationale was identical to Cross I in attempting to match high TDM and high HI across subspecies. However, in this cross, the high TDM parent was <u>major</u>, and the high HI parent was <u>minor</u>. The selected parents were 2N427 and 2N441. Their 1980 performance data is given below:

	2N427			(minor)		2N441			(major)
TDM	19.01g	SE	=	0.13g	TDM	43.32g	SE	=	1.26g
HI	69.4%	SE	=	1.3%	HI	40.4%	SE	=	0.5%

Again, it can be seen that the two lines differed significantly for TDM and HI.

Cross II was designed to match high TDM and high HI within the <u>major</u> subspecies. Thus both parents were of the <u>major</u> group, but one showed high relative TDM production, while the other showed a high HI value.

Accessions 2N441 and 2N268 were selected. Their performance data is shown:

2N441	(major)				2N268	(major)			
TDM	43.32g	SE	=	1.26g	TDM	18.65g	SE	=	3.18g
HI	40.4%	SE	=	0.5%	HI	64.8%	SE	=	0.9%

The lines differed significantly for both TDM and HI with 2N441 showing high TDM, and 2N268 showing high HI.

The rationale behind Cross III was exactly the same as Cross II, except that the matching of high TDM and high HI was within the <u>minor</u> subspecies. The parents selected were 2N535 and 2N427. Outlined below is their 1980 performance data:

2N535	(minor)				2N427	(minor)			
TDM	39.93g	SE	=	0.75g	TDM	19.01g	SE	=	0.13g
HI	47.8%	SE	=	1.00%	HI	69.4%	SE	=	1.3%

Accession line 2N535 was significantly higher for TDM, and 2N268 was significantly higher for HI.

Cross IV attempted to combine parents high for both TDM and HI across subspecies. That is, both parents performed relatively well for TDM and HI, but were from different groupings. Accessions 2N134 and 2N82 were selected as parents for this cross. They performed as follows:

2N134	(minor)				2N82	(major)			
TDM	36.4g	SE	=	7.1g	TDM	32.44g	SE	=	4.15g
HI	56.4%	SE	=	0.4%	HI	53.4%	SE	=	0.3%

Cross V was similar to Cross IV except that Cross V attempted to combine parents low for TDM and HI across subspecies. Accessions 2N96 and 2N355 were selected.

2N96	(minor)			2N355	(major)		
TDM	26.25g	SE =	7.85g	TDM	21.42g	SE =	1.47g
HI	45.3%	SE =	1.1%	HI	44.9%	SE =	1.2%

These accession lines had mean TDM and HI values lower than those selected for Cross IV, though these differences were not statistically significant.

In summary, the crossing program was designed as three pairs of crosses. Crosses I and VI were designed to match yield factors across subspecies. Crosses II and III were designed to match yield factors within subspecies. Crosses IV and V were designed to couple yield factors across subspecies.

Parental Performance 1980/1981.

Prior to an analysis of either the hybrid vigor experiment, or the spaced plant yield component experiment, it was decided to compare the relative performance of the parental accession strains in 1980 and 1981. The central issue was the heritability of TDM and HI, the traits on which the parental accession strains were selected. The experimental objectives did not specifically seek to derive heritability estimates; however, a comparison of strains between years allowed for a preliminary examination.

Tables 16 and 17 indicate the relative rank of the selected parental accession lines in terms of TDM and HI respectively. To avoid missing values, only 500 of the 535 lines were ranked.

TABLE 16

Ranking of parental accession lines for TDM, 1980 and 1981

Parental Accession	Desired TDM RANK	Actual Rank 1980	Actual Rank 1981
2N535	HI	424	239
2N427	LO	226	451
2N441	HI	258	371
2N134	HI	483	463
2N96	LO	104	285
2N82	HI	284	401
2N268	LO	286	282
2N355	LO	60	181

TABLE 17

Ranking of parental accession lines for HI, 1980 and 1981

Accession Line	Desired HI	Actual Rank	
	RANK	1980	1981
2N535	LO	161	224
2N427	HI	501	476
2N441	LO	67	287
2N134	HI	375	226
2N96	LO	188	61
2N82	HI	286	389
2N268	HI	484	424
2N355	LO	109	171

The overall rank correlation analysis, discussed earlier, would predict that for TDM there should be some relationship between 1980 rank and 1981 rank; but for HI, a relationship was not expected since the rank correlation was not significant.

As can be seen from Table 16, the results for TDM were not perfect, but do seem to indicate a certain degree of heritability for this trait. On a rather simplistic scale of high or low, all the parental accession lines, except 2N427, grouped similarly in both years. 2N427 ranked 226th in 1980, and was selected as a low TDM parent on this basis. In 1981, however, it ranked 451st to make it a relatively high TDM line. It was also noted that 2N82 ranked at 284th and was considered high in 1980, while 2N268 ranked 286th the same year and was selected as a low TDM parent. This discrepancy arose because of the difficulty in selecting a line that was simultaneously high for TDM and high for HI. The added restriction of high HI resulted in the selection of a parental line that was above average, but certainly not exceedingly high for TDM. In 1981 these lines separated into their appropriate categories, as desired.

The results pertinent to the HI parameter were surprisingly consistent. Except for accessions 2N441 and 2N134, all the lines grouped the same way (high or low) in 1981 as they did in 1980. The line 2N441 was selected as a low HI parent on its 1980 performance; but its 1981 relative performance improved considerably to garner a ranking of 287th. On the other hand, 2N134 which was selected for high HI on the 1980 result dropped to mediocrity with a 226th ranking in 1981.

One can conclude that a reasonably high degree of stability was evidenced by both TDM and HI over the two years. This indicates that there is some degree genetic control over these traits, and that the heritability estimates would probably be significant. These results are gratifying since selection of parents based on traits with zero heritability would be no better than selection at random; and certainly, the parents were selected with the specific purpose in mind to examine the interplay of TDM, HI and yield in their F1 hybrids.

F1 Hybrid Yield Evaluation: Plot Density.

Crosses as a group. The raw data from the plot density F1 hybrid yield evaluation is presented in Appendix F. As indicated earlier, an analysis of variance was employed to examine the data. A separate ANOVA was performed for each of TDM, yield, and HI.

The ANOVA table for TDM is presented in Table 18. This analysis dealt with all six crosses; the desigation "type" referred to the subplots, and indicated either open-pollinated parents, inbred parents, or F1 hybrid.

One observed a distinct effect of replications on TDM as indicated by the very significant F-ratio of 37.90 (p=.001). This replication effect was attributed to differential germination rates due to soil moisture variances at planting. There was no significant difference between crosses (F=0.86NS), but there was a highly significant type effect. That is, there was significant variation between F1 hybrids, open-pollinated parents, and inbred parents when one compared between groups based on type of breeding as the grouping criterion. The interaction terms were not significant which indicated that the effect on the type of breeding was not influenced by the cross, nor by the replication. A

TABLE 18

Summary ANOVA for TDM, HI, and Yield in the plot density split-plot experiment

Source	df	F-ratio		
		TDM	HI	Yield
Replications	2	37.90***	0.64 NS	27.36***
Crosses	5	0.86 NS	4.22*	4.21*
R x C	10			
	17			
Type	4	11.97***	12.39***	21.19***
Cross x Type	20	1.29 NS	0.63 NS	1.28 NS
Rep x Type	8	1.66 NS	0.82 NS	2.15 NS
Error b	40			
	89			

NS not significant

* significant at p=.05

*** significant at p=.001

Duncan's multiple range test further sudivided the type variation (Table 19). At a significance level of p = .05, there were basically three groupings: F1 hybrids, open-pollinated parents, and inbred parents. With the exception of the overlap between the parental groups, the basic pattern observed was that F1 hybrids outperformed open-pollinated parents who in turn did better than inbred parents.

For HI, the ANOVA table (Table 18) was quite different from that of TDM. Firstly, for HI the replication effect was not significant indicating that HI was not affected by replications, even though TDM was. The ANOVA also indicated that for HI, there was significant variation between crosses. The interaction terms were not significant again, and there was a significant effect of type on HI (F=12.39***).

The variable of major interest, however, was yield. The ANOVA for yield (Table 18) showed a highly significant effect due to replications (F=27.36***), which again was attributable to differential germination rates between replications. The effect of crosses was significant (F=4.21*) indicating considerable variation between crosses in terms of yield attainment.

As was the case with TDM, the type effect for yield was highly significant (F=21.19***) and the interaction terms were not significant. Proceeding in a similar manner, the Duncan's multiple range test split the type effect into three discrete categories (Table 20). The three categories coincide exactly with the type of breeding.

To summarize the analysis of all six crosses taken as a group, it was observed that there was a significant effect of replications on TDM and yield, but not HI. The type of breeding (that is, open pollinated parent, inbred parent, or F1 hybrid) significantly influenced all three

TABLE 19

Duncan's multiple range test for TDM as influenced by type of breeding

Type	MEAN TDM
3 - Fl hybrids	406.39 a
2 - Open poll. parent (female)	334.72 b
4 - Open poll. parent (male)	300.00 bc
1 - Inbred parent (female)	282.50 c
5 - Inbred parent (male)	280.83 c

Means followed by the same letter are not significantly different (p=0.05).

TABLE 20

Multiple range test for yield as influenced by type of breeding

Type	Mean Yield
3 - F1 hybrids	178.85 a
4 - Open poll. parent (male)	123.00 b
2 - Open poll. parent (female)	119.95 b
5 - Inbred parent (male)	95.97 c
1 - Inbred parent (female)	88.95 c

Means followed by the same letter are not significantly different (p=0.05).

parameters, with TDM and yield showing similar patterns, but HI showing a somewhat different one. There was a significant effect of crosses on yield and HI, but not TDM. Finally, there appeared to be a strong association between the degree of outbreeding and both yield and TDM; for HI, this relationship was present, but not nearly as apparent. These trends are illustrated graphically in Figure 12.

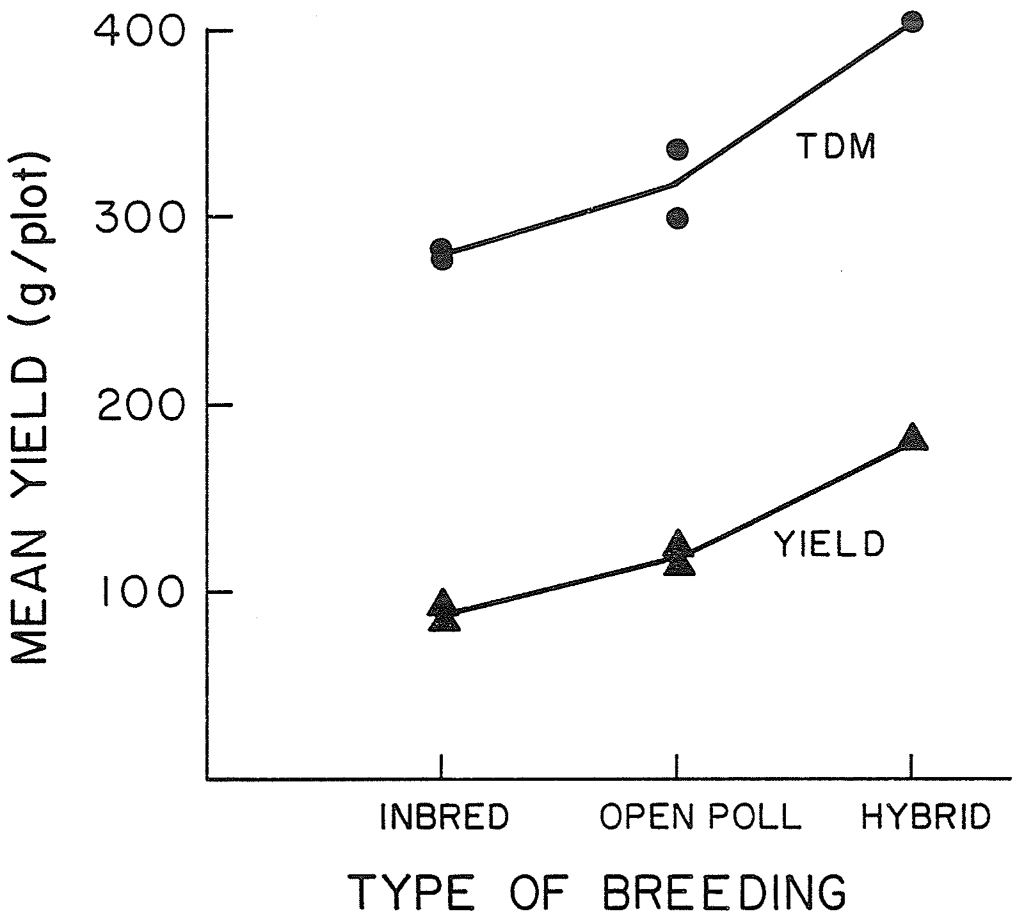

FIGURE 12. The influence of the degree of outbreeding on mean TDM, yield and HI over 6 crosses.

Individual cross comparison. To this point, the discussion has dealt with F1 hybrids, open pollinated parents, and inbred parents as groups over the six crosses. Perhaps of more interest, however, is the comparison of each F1 hybrid with its parents, on an individual cross basis.

For the purposes of this analysis, each F1 hybrid was compared to the mean of its open-pollinated parents (ie. the midparent). Tables 21 through 23 illustrate the hybrid vigour observed in each cross for TDM, HI, and yield.

In all crosses, hybrids outperformed their mid-parent for TDM production, ranging from 12% to 59% better. However, in the cases of Crosses III and VI only, was the observed heterosis statistically significant.

For HI, all F1 hybrids except that from Cross V showed an increase over the midparent. Only in the case of Cross II was the heterosis statistically significant. The observed range of F1 heterosis for HI was between -2.70% and 28.05%.

Yield heterosis was observed in the F1 hybrid of all the crosses. The range of increase was from 19.83% in Cross V to 83.25% in Cross VI. Of the six crosses, four showed statistically significant F1 yield heterosis: Crosses II, III, IV and VI.

One can conclude that the yield heterosis observed in Crosses III and IV was due primarily to F1 heterosis for TDM, though some contribution was made by increased HI. On the other hand, the observed yield heterosis in Cross II is attributed to F1 heterosis for HI, though again increased TDM production certainly played a role. The F1 from Cross IV

TABLE 21

F1 heterosis for TDM, individual crosses

CROSS	MID-PARENT TDM (g)	F1 HYBRID TDM (g)	PERCENT HETEROSIS
I	309.17	348.33	12.66
II	346.67	411.67	18.75
III	328.33	430.00	30.96*
IV	301.67	370.00	22.65
V	315.84	395.00	25.06
VI	302.50	483.33	59.78***

* significant at p=.05

*** significant at p=.001

TABLE 22

F1 heterosis for HI, individual crosses

CROSS	MID-PARENT HI (%)	F1 HYBRID HI (%)	PERCENT HETEROSIS
I	40.8	45.0	10.30
II	41.07	52.5	28.05*
III	39.0	46.6	19.49
IV	36.6	44.7	22.13
V	34.2	33.3	-2.70
VI	37.4	42.1	12.57

* significant at p=.05

TABLE 23

F1 heterosis for yield, individual crosses

CROSS	MID-PARENT YIELD (g)	F1 HYBRID YIELD (g)	PERCENT HETEROSIS
I	125.22	157.47	25.75
II	143.10	216.60	51.36**
III	128.71	201.63	56.65**
IV	112.26	163.60	45.73*
V	108.13	129.57	19.83
VI	111.45	204.23	83.25***

* significant at p=.05
** significant at p=.01
*** significant at p=.001

showed significant yield heterosis that can be attributed to simultaneous increases in both TDM and HI, though neither alone was sufficient to reach the 5% significance level.

Parent comparison, inbreds and open pollinated. Continuing in the vein of within cross comparisons, inbred parents and open pollinated parents were contrasted. The results are summarized in Table 24.

In the comparison of open-pollinated the mid-parent value with inbred mid-parent value for each individual cross, there was no significant difference between mid-parent types for TDM, HI or yield. The open pollinated mid-parent value for HI approached a significant advantage for Crosses V and VI , and for yield approached significance in Crosses II, III and VI.

One sees from Table 24 that, except for Cross IV, the open-pollinated parent out-performed the inbred parent for all three traits. Though this advantage was not significant statistically, the pattern was firmly established. The anomaly is Cross IV in which the inbred showed a slight advantage, and it is thought that this result arose simply due to sampling error.

Of note is that those crosses which show significant inbreeding depression for yield were the same crosses which showed significant F1 yield heterosis (Cross IV excepted). That is, Crosses II, III, and VI showed yield inbreeding depression of 27.1%, 30.0%, and 36.2% respectively; these crosses also showed significant F1 yield heterosis values of 51.4%, 56.7%, and 83.3% respectively. The appearance of this relationship between inbreeding depression and heterosis is not unexpected since both processes are intimately linked with the release of genetic variability and the degree of heterozygosity.

TABLE 24

Mean values of TDM, HI and yield for inbred and open-pollinated parents, individual crosses

Cross No.	TDM		HI		Yield	
	INBRED	OPEN POLL.	INBRED	OPEN POLL.	INBRED	OPEN POLL.
I	270.5	309.17	34.86	40.80	92.65	125.22
II	300.0	346.67	34.36	41.00	104.33	143.10
III	257.5	378.33	34.93	39.00	90.12	128.71
IV	327.5	301.67	36.64	36.60	116.13	112.26
V	300.0	315.84	25.53	34.20	80.41	108.13
VI	242.5	302.50	30.12	37.40	71.15	111.45

Pairwise cross comparison. Bearing in mind that another objective of the crossing program was to examine whether or not subspecies effects could be detected in the crosses, the pairs of crosses, as outlined previously, were investigated more closely. Firstly, for Crosses II and III, which sought to examine matching TDM and HI within a subspecies, there was no significant difference between F1's of either cross for yield, TDM or HI. That is, there was no difference between matching in the minor grouping compared to matching within the major grouping since the F1 hybrids from each cross performed equally.

Secondly, Crosses I and VI, sought to examine matching TDM and HI across subspecies. Where the minor parent was high in TDM (Cross I) the F1 was significantly higher for TDM than when the major parent was the high TDM source (Cross VI). However, the F1's were not significantly different for yield or HI.

Finally, for Crosses IV and V which sought to examine coupling of low or high TDM and HI across subspecies, there was no significant difference between F1's for yield, TDM, or HI. In other words, the F1 produced by crossing high TDM/high HI x high TDM/high HI did not differ significantly from the F1 produced from the low TDM/low HI X low TDM/low HI cross. This result is surpising since one would expect the 'double low' derived F1 to yield less than the 'double high' derived F1. However, at this density, the parents which were supposedly selected to be divergent for TDM and HI, showed no statistically significant difference. The inbred parents in Cross IV showed a mean TDM of 327.5g and a mean HI of 36.6% whereas the inbred parents in Cross V showed a mean TDM of 300.0g and HI of 25.5% (Table 24). While there was certainly a trend towards divergence, it was not statistically significant, and hence the F1s produced from these crosses did not differ significantly in yield as first expected.

F1 Yield Components: Spaced Plants.

All crosses grouped. In addition to the plot density experiment, inbred parents and F1's produced in the crossing program were also grown as spaced plants in an experiment focusing on yield components. The raw data for this evaluation is presented in Appendix G. Similar statistical techniques were applied to the spaced plant data as were applied to the plot density data reported above.

Summary ANOVA statistics are supplied for reference in Table 25.

There was significant variation between crosses for HI, seed number per pod, and seed weight. This variation was partitioned for closer examination using a Duncan's Multiple Range Test (Table 26).

The range test for HI showed more of a continuum than a definitive breakdown into groups. However, Cross V did show the lowest mean HI value as expected from the LL x LL cross. Cross IV, though, which was HH x HH had a mean HI value of 35.91% which was not significantly higher than the 31.48% value for Cross V. The remaining Crosses (I,II,III,VI) have significantly higher HI values than Cross V.

For seed number per pod, the Duncan's multiple range test did give conclusive results. As is obvious from Table 26, the variability in seed number per pod was continuous; one can note, though, that the crosses tended to group in their pair combinations. That is Crosses II and III were the top two for seed number per pod, Crosses IV and V the lowest, and Crosses I and VI were mediocre.

TABLE 25

F-ratio summary for ANOVA's conducted on spaced plant yield related traits

Source of Variation	df	F-RATIO					
		TDM	YIELD	HI	PODS	S/POD	MKWT
Replications	1	30.9**	9.2*	2.6	2.4	0.4	12.2*
Crosses	5	0.5	3.4	9.1*	1.5	8.0*	299.4***
R x C	5						
	11						
Type	2	8.0**	7.7**	6.3*	4.6*	3.1	3.6
Cross x Type	10	1.5	1.4	1.0	0.8	2.9	2.0
Rep x Type	2	1.2	1.7	1.0	1.5	2.6	0.5
Error b	10						
	35						

* significant at p=.05
** significant at p=.01
*** significant at p=.001

TABLE 26

Duncan's multiple range tests for HI, seed number per pod and 1000 seed weight for individual crosses

	VARIABLE		
CROSS NUMBER	HI	SEEDS/POD	MKWT
I	42.84 bc	2.85 bc	438.52 cd
II	54.21 a	3.23 a	658.09 a
III	45.93 abc	2.97 ab	414.42 d
IV	35.91 cd	2.53 c	461.69 c
V	31.48 d	2.66 c	267.53 e
VI	51.48 ab	2.97 ab	506.97 b

Within a column, means followed by the same letter are not significantly different (p=.05).

The partitioning into discrete groups was much better for seed weight. Cross II which was a major x major cross showed the highest mean seed weight. Cross V, a minor x major cross, but LL x LL, had the lowest mean seed weight. The minor x minor Cross III was next lowest, and the remaining Crosses I, IV, and VI were in between as would be expected of minor x major crosses. The segregation of the crosses in this manner aligned well with expected results, and was further evidence of the high heritability of seed weight.

Returning to the origial F-ratio summary (Table 25), it was obvious that for all characters except seed number per pod, and seed weight, there was a significant type effect. That is, there was significant variation between F1's and parents over the group of six crosses. Again, Duncan's multiple range test results are presented (Table 27) to further examine the variability.

The results obtained for TDM, and yield were identical in that, as a group, the F1's significantly outperformed their parents. Those results parallel the results obtained at plot density where F1s were in a separate category with the highest yield and TDM, and parent groups were not significantly different from each other.

The primary yield component, pod number per plant, was significantly higher for the F1's than for parents. This result added emphasis to the importance of pod number per plant as a yield component since it grouped identically with yield in the range test.

The HI grouping pattern is less readily interpretable. The F1 group was still the best performer, but was not significantly better than the mean of the Parent 1 group. The mean HI for Parent 2 group was significantly lower than either F1's or Parent 1.

TABLE 27

Mean values for various yield related traits over 6 crosses

Type	TDM	YIELD	HI	PODS	SEEDS/POD	MKWT
F1 Hybrid	63.18a	32.79a	49.43a	23.28a	2.91ab	502.96a
Parent 1	49.22b	18.60b	46.88a	16.67b	2.67a	481.14ab
Parent 2	42.13b	19.94b	34.62b	15.18b	3.02b	389.53b

Within a column, means followed by the same letter are not significantly different (p=.05).

Both seed number per pod, and seed weight tended toward a continuum as would be expected by the lack of a significant F-value as indicated in Table 25.

Individual crosses. The analysis of spaced plant results has thus far dealt with F1s and parents as groups over the six crosses. It was necessary, to examine also the performance of each individual F1 with its respective parents.

Heterosis over midparent values were calculated, and the results are presented in Table 28.

The F1 showed highly significant yield heterosis in all crosses except Cross IV which showed heterosis but not at a level to be statistically significant. It was apparent that the observed increase in F1 yield was due to increased TDM production in Crosses I, and VI, to increased HI in Cross V, and to increased TDM and HI in Crosses II and III.

The yield component, pod number per plant, paralleled closely the yield response, with all F1's, except those from Crosses IV and VI, showing significant heterosis for this trait. Positive heterosis was observed for all F1's.

Seed number per pod was significantly less than the midparent value for Cross I, and Cross II showed a similar (though non-significant) reduction. All the other F1's showed a positive change in seed number per pod over the midparent, but only in Cross IV was this significant.

Seed weight showed significant heterosis in the F1's of Crosses II and III, but was essentially zero for the other crosses. This indicated that seed weight exhibited a heterotic response in F1's of

TABLE 28

Spaced plant F1 heterosis for TDM, HI, pod number per plant, seed number per pod and 1000 seed weight, individual crosses

	PERCENT HETEROSIS OVER MIDPARENT					
CROSS NUMBER	TDM	YIELD	HI	PODS	SEEDS/POD	MKWT
I	35.3***	45.4**	1.9	59.9***	-27.2***	0.0
II	50.9***	74.9***	21.4***	44.0*	- 6.1	30.6***
III	89.3***	182.4***	51.0***	77.6***	32.2***	38.4***
IV	15.0	22.1	17.0	22.0	4.2	10.3
V	14.6	73.6***	50.8***	45.2***	8.5	2.1
VI	33.0***	39.0**	1.8	25.2	6.9	1.2

* significant at p=.05
** significant at p=.01
*** significant at p=.001

intra-subspecific crosses (II and III), but not in the F1's of the inter-subspecific crosses (I,IV,V,VI). Perhaps the intra-subspecific F1's retained a better genic balance that allowed for full expression of seed weight; a balance that was destroyed in the wider crosses.

Pairwise cross comparison. In comparing Crosses II and III it can be seen that the F1 from Cross III produced significantly more TDM than the F1 from Cross II despite the fact that their midparents were almost identical. Cross II carried this advantage into yield, but the difference was not statistically significant. The yield structure of the respective F1's was notably different. Whereas in Cross III, the F1 hybrid had a significantly greater number of pods per plant and seeds per pod, the Cross II derived F1 had a significantly higher seed weight. This was expected since Cross III was between *minor* parents, and Cross II was between *major* parents.

The cross pair of I and VI sought to compare *major* parents versus *minor* parents as souces of high TDM and the effect of this on yield. It was evident that the F1's of both crosses yielded equally. This indicated that source of TDM did not influence final yield, nor for that matter did it influence F1 TDM. Again, however, the yield structure in the F1's was different. Cross VI derived F1 had higher seed weight and seed number per pod than the F1 from Cross I. The Cross I F1 had a higher number of pods per plant, however. Since both crosses were of the *minor* X *major* type, this structural yield difference appeared to be an indication of yield component compensation.

Crosses IV and V sought to contrast a low TDM, low HI with a high TDM, high HI cross. The results obtained indicated no difference between these crosses in terms of F1 yield or TDM. However, this result must be considered in light of the fact that in this experiment, the parents themselves were not significantly different for either of these traits. It seemed senseless therefore, to look for differences between F1's when parental differences did not exist. Once again, however, yield structure differences were evident despite the fact that yield was not significantly different between the F1 hybrids of each cross. The crosses were not significantly different for seed number per pod, but Cross IV F1's held a significant advantage for seed weight while Cross V F1's performed significantly better for pod number per plant.

Spaced Plants/Plot Density Comparison.

The final step in the analysis of the two crossing experiments, was to bring them together. From this simultaneous examination, a preliminary investigation of plant density effects could be gained.

Donald and Hamblin (1976), and Fisher (1975) considered extensively the problems associated with selecting, at spaced plant density, breeding material that will eventually be evaluated and produced commercially at much higher densities. To this end, spaced plant characteristics and plot yield were compared. The resulting correlations are presented in Table 29.

The results obtained in this comparison agreed in general with those of Fisher (1975) in that yield per plant and HI were significantly correlated with plot yield. However, in this study, the best predictor of plot yield was spaced plant yield, and HI was a less reliable (though still significant) predictor. Fisher (1975) worked on wheat and did not present results for dry matter, but it, too, appeared to be a reliable predictor of final plot yield based on these data. It is obvious, also, that yield components as plot density yield predictors were of no value.

TABLE 29

Correlations between single spaced plant characteristics and plot yield for 18 faba bean genotypes

Spaced Plant Characteristic	Correlation with plot yield
SEEDS	0.427
PODS	0.267
HEIGHT	0.135
YIELD	0.747***
TDM	0.686**
NODES	0.345
STALKS	0.143
HI	0.474*
SEEDS/POD	0.311
PPNODE	0.048
MKWT	0.430

* significant at p=.05
** significant at p=.01
*** significant at p=.001

On this limited basis, it was concluded that plant yield was the best predictor of plot yield in faba beans; however, a more extensive test of this hypothesis would be required before a definitive statement was made. The study should also investigate further the roles of TDM and HI as yield predictors to straddle the spaced-plant/plot density problem.

GENERAL DISCUSSION AND CONCLUSIONS

Accession Characterization

The mean yield of seed, and dry matter production, was approximately doubled in 1980 over the 1981 values. These yield differences were very much a reflection of the variability of the environmental conditions between years. A rank correlation, which ranked strains relative to each other in each year and then compared the rank between years, proved to be highly significant. This indicated that each strain responded similarly, relative to the other strains, over both years despite the absolute yield and dry matter production differential. On this basis it was concluded that though its magnitude differed between years, the nature of the genotype x environment interaction was consistent. In other words, the strains were distributed similarly for Yield and TDM in both years, but the scales were different.

For the variables examined, frequency distributions approximated the normal distribution for the most part. Mean values and ranges were approximately double in 1980 compared to 1981, for yield, TDM, and pod number per plant. The frequency distributions for seed number per pod were identical over both years, indicating a very strong genetic influence with little environmental interaction. Seed size indicated a weak separation of the population into <u>major</u> and <u>minor</u> subspecies in 1980, but this result was not reproduced in 1981. Seed size is reported to be highly heritable, but apparently environmental differences were sufficiently potent as to offset the genetic effects controlling the expression of this trait. Simple regressions of many of the measured variables on seed size indicated that higher seed weight was associated with lower plant height, lower pod number, lower seed number per pod, and lower number of pods per podded node; as well, higher seed weight was associated with increased number of stalks, increased yield and increased TDM. These results confirmed the expected association of yield components and plant type within the minor or major subspecies, but no distinct division between groups was observed.

Discriminate analysis, using geographic origin as the prior grouping criterion, was successful in sub-dividing the accession population into three smaller groups. Moreover, the repeatability of this technique over both years prompted a serious re-examination of the accuracy of the geographic origin data currently on hand for several accession strains.

The interplay of various yield related traits was analyzed using several multivariate techniques including multiple regression, factor analysis, and path co-efficient analysis. It was discovered that approximately 85% of yield variability was accounted for by dry matter production, seed weight, pod number per plant, and seed number per pod using multiple regression.

The path co-efficient analysis was effective in determining direct and indirect effects of yield related traits on yield. Once again, TDM and pod number per plant were of primary importance; but seed weight and seed number per pod also exhibited noteworthy direct effects.

Factor analysis isolated seven critical factors from the 12 variables examined. Thus, it was determined that by measuring eight of the 12 characters actually detailed, most of the important variability would still be observed. These traits were TDM, maturity, pods per podded node, seed number per pod, 1000 seed weight, days from emergence to flowering, height and stalk number per plant. Factor analysis as such, suggested a method of simplifying data collection without sacrificing accuracy, and so would enable further time to be spent on characterization of variability expression for other traits.

The multiple regression approach, and path co-efficient analysis both examined yield related traits and the manner in which yield variability could be accounted for by these components. Factor analysis, on the other hand sought not to explain yield variability, but rather to find a simpler method by which the total variation in the population for all the traits could be more simply measured.

F1 Hybrid Crossing Program

In the high density plots, all F1 hybrids showed yield heterosis, with values ranging from 19% to 83% over midparent. In four of the 6 crosses, the F1 heterotic yield response was statistically significant. This observed yield heterosis was due to both heterosis for TDM and heterosis for HI. There did not appear to be a negative relationship between TDM and HI, which would indicate that breeding programs aimed at increasing either trait separately, or both in combination, would meet with positive results in terms of yield increases.

The comparison of inbred parents, open pollinated parents, and F1 hybrids revealed that those strains showing greatest inbreeding depression also showed maximum heterosis. This would indicate that a characterization of the degree of inbreeding depression that a strain suffered would perhaps aid in the prediction of the expected heterotic response of an F1 produced from that strain.

The crossing experiments indicated also that the source of high TDM or high HI, whether it be a major strain or a minor strain, was not particularly important in determining F1 yield since both types performed equally well. The results also pointed out the difficulty of selecting parental strains based on data from a single year. For example, in a pair of crosses designed to produce a low yielding F1 and high yielding F1, the parental strains were not sufficiently different in TDM or HI to produce significantly different F1 yields. Certainly, the trends hypothesized were present, but not at a level of significance to be statistically meaningful.

However, the overall success rate in selecting parental strains high or low for either TDM or HI was quite good. The comparison of 1980 ranking versus 1981 ranking showed that within certain limits, selected material performed similarly from year to year. This pointed to a considerable degree of genetic influence over these traits, and it is expected that reasonably high heritability estimates would be obtained from experiments designed to detail the genetic influence more closely.

The single spaced plant analysis results paralleled those of the plot density experiment in that F1 heterosis was observed for yield, TDM and pod number per plant for all six crosses. F1 yield ranged from 22% to 182% over mid-parent values, and was significantly better in all but one cross. A heterotic response was also observed in the F1s for both TDM and HI.

The yield related trait analysis revealed significant differences between F1s in terms of yield structure. That is, the contribution of various yield components to yield was different between hybrids. The intrasubspecific hybrids showed that F1 plants derived from <u>minor</u> parents had significantly greater number of pods per plant and seed number per pod, and significantly lower seed weight than F1 plants derived from <u>major</u> parents. The yield structure was different, even though the seed yields were not significantly different. A similar pattern of equal yield, but divergent yield structure was exhibited by the intersubspecific F1 hybrids, and attributed to yield component compensation.

Finally, a correlation between spaced plant characteristics and plot yield (commercial density) revealed that spaced plant yield was the best predictor of plot yield, but TDM and HI also showed significant correlation with plot yield. No yield component was of significant predictive value.

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APPENDIX A. 1980 RAW DATA

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
2	2N 1	24.0000	44.0000	56.000	26.3333	93.333	270.667	35.000	89.333	18.0000	3.3333	42.1	2.53	1.51	785
3	2N 2	37.0000	34.0000	108.000	32.0000	101.000	149.000	54.667	116.333	21.3333	2.3333	46.2	3.37	1.55	500
4	2N 3	18.0000	46.0000	62.000	22.6667	56.000	147.000	16.533	27.667	11.0000	1.6667	64.5	2.59	2.06	337
5	2N 4	20.0000	40.0000	77.333	28.6667	62.333	145.000	25.333	41.333	18.3333	3.0000	63.1	2.71	1.6	326
6	2N 5	44.0000	34.0000	26.000	8.6667	119.000	143.000	17.333	67.667	7.6667	2.3333	24.8	3.01	1.11	667
7	2N 6	43.0000	32.0000	64.667	18.0000	91.333	151.000	30.033	66.333	13.0000	2.0000	46.4	3.58	1.35	511
8	2N 7	44.0000	34.0000	78.333	23.6667	128.333	151.000	38.533	116.333	15.6667	2.6667	33.8	3.35	1.51	491
9	2N 8	42.0000	29.0000	79.000	28.0000	96.667	151.000	53.600	108.667	15.6667	2.3333	49.1	2.73	1.78	757
10	2N 9	29.0000	27.0000	115.000	40.0000	80.000	135.000	54.333	98.667	24.0000	3.6667	55.6	2.94	1.76	473
11	2N 10	25.0000	40.0000	76.000	23.3333	86.667	151.000	42.867	76.333	17.3333	2.0000	56.5	3.26	1.42	555
12	2N 11	18.0000	27.0000	108.000	41.0000	80.000	124.000	84.000	155.000	33.0000	4.3333	54	2.64	1.28	744
13	2N 12	18.0000	30.0000	130.667	37.3333	64.000	123.000	47.800	70.667	21.6667	5.3333	89.9	3.72	1.75	346
14	2N 13	28.0000	39.0000	45.667	14.3333	68.667	147.000	33.333	44.333	9.3333	2.3333	75.4	3.23	1.55	757
15	2N 14	18.0000	33.0000	169.667	60.6667	73.667	123.000	65.033	97.333	34.6667	5.6667	66.9	2.79	1.75	383
16	2N 15	17.0000	34.0000	270.000	79.6667	93.667	143.000	114.700	222.000	53.0000	5.3333	48.8	3.31	1.55	429
17	2N 16	18.0000	29.0000	134.000	45.6667	91.667	124.000	76.333	136.333	29.0000	2.6667	56.4	2.99	1.59	553
18	2N 17	18.0000	35.0000	155.667	59.3333	104.333	140.000	104.333	198.667	38.6667	4.0000	54.3	2.39	1.53	833
19	2N 18	17.0000	34.0000	110.000	40.6667	103.333	120.000	76.633	155.667	31.3333	4.3333	51.6	2.7	1.31	695
20	2N 19	17.0000	31.0000	157.000	53.3333	96.000	120.000	94.400	174.667	38.6667	5.3333	55	3	1.4	602
21	2N 20	18.0000	30.0000	143.000	48.0000	74.000	131.000	64.667	108.333	29.3333	4.0000	60.8	3.04	1.53	483
22	2N 21	42.0000	28.0000	78.667	22.6667	99.000	151.000	49.867	95.000	17.3333	2.3333	52.6	3.47	1.33	653
23	2N 22	42.0000	31.0000	40.667	19.0000	103.000	149.000	30.667	61.333	12.0000	1.6667	50.1	2.25	1.58	801
24	2N 23	43.0000	35.0000	111.000	30.3333	105.333	147.000	41.000	87.333	18.3333	2.0000	47.7	3.6	1.81	371
25	2N 24	43.0000	34.0000	81.000	26.3333	108.333	145.000	37.533	93.000	14.6667	3.0000	40.6	3.07	1.8	460
26	2N 25	43.0000	33.0000	85.667	27.3333	103.667	143.000	36.133	92.667	20.3333	3.3333	37.8	3.17	1.37	409
27	2N 26	43.0000	30.0000	135.167	43.6667	99.167	142.000	72.750	135.667	30.6667	3.0000	54.3	3.21	1.48	548
28	2N 27	19.0000	40.0000	79.000	31.3333	111.333	140.000	49.633	103.333	18.3333	2.0000	48.3	2.52	1.72	637
29	2N 28	17.0000	40.0000	69.667	27.6667	93.667	124.000	31.900	61.333	15.0000	2.6667	45	2.52	1.84	446
30	2N 29	17.0000	22.0000	55.000	18.3333	82.333	135.000	39.533	71.667	9.3333	2.3333	55.2	2.9	1.97	719
31	2N 30	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	2N 31	42.0000	29.0000	124.000	40.6667	94.333	151.000	61.000	124.000	26.6667	4.0000	49.6	3.22	1.61	496
33	2N 32	18.0000	34.0000	145.667	46.6667	90.333	149.000	89.400	153.667	31.6667	3.3333	58.1	3.21	1.47	626
34	2N 33	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	2N 34	18.0000	22.0000	93.333	43.6667	89.667	145.000	46.333	76.333	20.0000	4.6667	57.2	1.92	2.14	543
36	2N 35	18.0000	27.0000	105.333	31.3333	65.000	123.000	27.867	61.667	27.3333	13.3333	44.9	3.11	1.13	323
37	2N 36	17.0000	38.0000	145.667	50.0000	96.667	142.000	98.333	189.333	35.3333	4.6667	53.1	2.91	1.43	670
38	2N 37	17.0000	35.0000	81.667	30.6667	94.000	120.000	55.200	92.667	25.6667	4.3333	59.4	2.77	1.19	713
39	2N 38	17.0000	30.0000	211.667	62.3333	65.000	124.000	57.100	96.667	36.3333	6.3333	59.9	3.38	1.71	284
40	2N 39	17.0000	30.0000	162.667	60.3333	77.333	113.000	45.067	65.667	35.3333	5.6667	71.7	2.69	1.71	287
41	2N 40	18.0000	39.0000	116.667	40.0000	65.667	132.000	34.667	57.667	23.3333	5.3333	61.3	2.92	1.74	300
42	2N 41	41.0000	26.0000	173.000	45.3333	102.333	151.000	55.333	123.667	28.6667	3.6667	45	4.54	1.6	348
43	2N 42	17.0000	35.0000	145.667	52.6667	68.333	123.000	76.167	96.333	24.6667	4.6667	77.7	2.76	2.14	534
44	2N 43	42.0000	32.0000	214.667	58.3333	103.000	147.000	64.667	140.333	36.0000	3.0000	45.9	3.75	1.63	301
45	2N 44	43.0000	29.0000	116.333	38.6667	93.333	145.000	45.933	79.333	21.6667	3.0000	57.4	3.21	1.84	419
46	2N 45	43.0000	26.0000	40.667	19.0000	99.667	143.000	28.333	54.333	14.6667	1.6667	52.2	2.28	1.28	730
47	2N 46	43.0000	31.0000	74.667	23.0000	71.667	142.000	32.300	83.333	14.3333	2.6667	40.1	3.18	1.58	450
48	2N 47	18.0000	34.0000	60.000	31.3333	91.000	124.000	55.633	110.667	23.6667	4.6667	46.8	2.07	1.53	1015
49	2N 48	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	2N 49	21.0000	38.0000	70.500	23.5000	102.500	135.000	34.050	76.500	20.0000	4.5000	44.2	2.95	1.17	519
51	2N 50	18.0000	35.0000	102.333	51.0000	70.667	131.000	65.700	106.667	31.3333	6.0000	57.4	2.08	1.61	632
52	2N 51	23.0000	32.0000	41.333	27.0000	76.000	124.000	60.800	122.000	20.6667	6.0000	51.4	1.81	1.27	1801
53	2N 52	17.0000	29.0000	88.333	37.0000	67.667	111.000	79.833	113.667	23.3333	7.6667	70.2	2.43	1.58	911
54	2N 53	17.0000	28.0000	76.667	38.6667	69.667	111.000	58.200	79.333	25.3333	5.6667	71.9	1.96	1.55	809
55	2N 54	17.0000	29.0000	161.667	60.3333	87.000	107.000	123.033	205.000	49.0000	10.0000	60.4	3.01	1.26	884
56	2N 55	42.0000	30.0000	112.667	37.3333	76.667	123.000	38.133	54.000	18.3333	4.3333	69.1	2.98	1.99	336

OBS	ACCNBR .	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
57	2N 56	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	2N 57	17	28.0000	56.000	16.0000	75.667	112.000	56.300	93.333	10.6667	3.33333	61.8	3.41	1.53	1027
59	2N 58	17	25.0000	233.000	81.6667	90.000	124.000	107.500	202.667	51.0000	6.00000	52.6	2.8	1.6	469
60	2N 59	17	27.0000	109.000	51.6667	76.667	112.000	61.667	112.333	38.0000	7.33333	53.6	2.08	1.36	603
61	2N 60	18	34.0000	179.667	67.3333	90.333	120.000	85.500	126.333	45.0000	6.33333	67.1	2.67	1.48	476
62	2N 61	42	31.0000	85.333	30.6667	101.667	151.000	38.467	80.333	24.3333	3.66667	48.3	2.8	1.27	452
63	2N 62	41	34.0000	166.333	47.3333	95.667	149.000	59.333	117.667	24.0000	3.66667	50.1	3.52	1.97	366
64	2N 63	18	29.0000	79.000	26.6667	103.333	147.000	33.833	78.000	20.6667	3.33333	44.8	3.02	1.3	459
65	2N 64	42	26.0000	124.333	39.3333	100.000	145.000	82.000	150.333	30.0000	3.66667	54.7	3.13	1.35	683
66	2N 65	43	30.0000	88.667	30.6667	116.667	143.000	44.700	96.000	20.0000	2.33333	45.5	2.84	1.54	513
67	2N 66	44	32.0000	74.667	31.3333	138.333	135.000	46.533	135.667	20.6667	2.66667	33.8	2.43	1.5	596
68	2N 67	44	35.0000	129.000	36.3333	114.000	140.000	50.667	137.000	25.6667	3.33333	37	3.55	1.42	394
69	2N 68	20	33.0000	93.000	37.0000	79.667	136.000	45.233	85.667	22.3333	4.33333	54	2.68	1.6	462
70	2N 69	44	35.0000	127.667	48.0000	93.333	135.000	68.833	135.333	32.6667	3.33333	46.8	2.79	1.47	529
71	2N 70	44	28.0000	53.667	18.0000	99.333	155.000	29.467	66.667	10.6667	2.33333	44.7	2.88	1.75	571
72	2N 71	42	32.0000	63.333	20.8333	113.000	151.000	29.833	77.500	14.8333	2.83333	40	3.03	1.49	479
73	2N 72	45	32.0000	29.667	18.6667	112.333	149.000	27.767	89.333	15.6667	3.00000	31.5	1.66	1.28	1639
74	2N 73	42	25.0000	72.333	22.6667	106.000	147.000	38.300	83.333	16.3333	3.00000	45.9	3.11	1.48	591
75	2N 74	44	26.0000	75.000	20.0000	113.667	145.000	58.867	117.000	18.0000	2.66667	50.5	3.79	1.11	793
76	2N 75	42	28.0000	20.333	10.0000	62.000	143.000	37.200	143.000	8.6667	3.33333	23.5	1.9	1.24	1782
77	2N 76	42	29.0000	72.667	25.0000	123.333	142.000	41.333	81.000	21.6667	2.33333	50.5	3.08	1.13	587
78	2N 77	.	.	.	.	.	.	.	.	.	.	.	.	.	.
79	2N 78	44	25.0000	66.667	21.6667	94.333	136.000	52.300	95.000	17.0000	2.66667	56	2.9	1.25	895
80	2N 79	.	.	.	.	.	.	.	.	.	.	.	.	.	.
81	2N 80	43	26.0000	44.000	13.0000	79.000	154.000	43.700	76.000	12.6667	3.66667	57.7	3.37	1.03	1028
82	2N 81	18	25.0000	109.333	37.0000	75.333	124.000	102.100	173.667	30.6667	7.00000	59.1	3.1	1.21	1082
83	2N 82	18	28.0000	57.000	18.0000	95.667	149.000	52.467	97.333	17.0000	3.00000	53.5	3.15	1.07	953
84	2N 83	43	25.0000	71.333	26.6667	109.000	146.333	39.333	87.000	21.6667	3.66667	46.7	2.7	1.24	557
85	2N 84	43	28.3333	90.333	25.0000	106.333	145.000	55.500	98.000	17.0000	2.33333	57.8	3.58	1.39	729
86	2N 85	18	32.0000	38.667	14.0000	84.667	143.000	33.400	73.333	12.3333	2.33333	45.2	2.77	1.14	855
87	2N 86	20	31.0000	33.000	10.3333	108.000	142.000	24.333	40.333	8.3333	1.33333	60.7	3.37	1.24	701
88	2N 87	44	25.0000	38.000	14.0000	109.000	140.000	31.333	69.000	14.0000	2.33333	46.1	2.7	1	827
89	2N 88	44	28.0000	78.667	25.3333	96.333	136.000	48.233	86.333	19.6667	3.00000	56.7	3.08	1.28	608
90	2N 89	40	28.0000	32.333	12.6667	93.000	153.000	31.100	56.000	11.3333	2.00000	54.7	2.54	1.14	1115
91	2N 90	.	.	.	.	.	.	.	.	.	.	.	.	.	.
92	2N 91	18	28.0000	40.000	16.6667	87.667	151.000	43.267	87.000	10.6667	4.00000	47.4	2.52	1.35	1256
93	2N 92	43	23.0000	44.000	17.3333	83.333	149.000	40.333	71.333	15.6667	2.66667	54.7	2.5	1.11	901
94	2N 93	18	30.0000	12.000	11.0000	66.000	147.000	15.000	94.000	11.0000	5.00000	16	1.09	1	1250
95	2N 94	44	29.0000	86.667	28.0000	119.333	145.000	32.267	98.000	16.6667	2.66667	32.7	3.13	1.64	395
96	2N 95	.	.	.	.	.	.	.	.	.	.	.	.	.	.
97	2N 96	30	30.0000	64.800	26.4000	109.200	142.000	35.700	71.600	18.0000	2.80000	49.5	2.6	1.44	561
98	2N 97	43	30.0000	52.000	18.0000	118.000	140.000	33.733	73.000	16.0000	2.00000	46.2	2.93	1.12	809
99	2N 98	42	31.0000	48.333	16.3333	102.000	136.000	46.700	91.667	14.3333	2.33333	50.7	2.98	1.16	972
100	2N 99	43	25.0000	76.000	26.6667	78.667	135.000	51.633	99.667	17.0000	2.66667	51.4	2.83	1.62	716
101	2N100	30	29.0000	115.167	33.8333	96.167	154.000	60.983	112.167	27.5000	3.33333	54.2	3.43	1.29	549
102	2N101	43	26.0000	152.000	60.3333	99.000	151.000	87.333	172.333	37.3333	4.33333	51.4	2.48	1.62	606
103	2N102	.	.	.	.	.	.	.	.	.	.	.	.	.	.
104	2N103	43	31.0000	167.667	60.0000	97.667	147.000	99.967	195.000	38.3333	7.00000	50.6	2.63	1.51	760
105	2N104	42	31.0000	78.667	27.0000	112.333	145.000	48.500	100.000	23.0000	2.66667	48.7	2.91	1.18	624
106	2N105	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107	2N106	42	29.0000	42.667	16.0000	106.667	142.000	30.767	59.667	14.6667	2.00000	51.2	2.63	1.09	736
108	2N107	43	29.0000	111.000	37.6667	106.000	140.000	64.667	122.667	28.6667	3.66667	52.7	2.96	1.34	583
109	2N108	.	.	.	.	.	.	.	.	.	.	.	.	.	.
110	2N109	42	27.0000	55.667	17.0000	97.000	135.000	38.333	74.000	15.0000	3.00000	51.3	3.22	1.13	722
111	2N110	42	27.0000	78.333	26.3333	94.667	131.000	50.333	94.000	21.6667	3.00000	55.1	3.42	1.24	655
112	2N111	42	26.0000	63.667	23.6667	85.000	151.000	44.100	89.667	17.0000	2.33333	49.2	2.7	1.38	706

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OBS ACCNBR             EMERG   FLOWER  SEEDS    PODS     HEIGHT  MATURITY  YIELD     TDM    NODES     STALKS    HI  SEEDSPOD PPNODE MKWT

113 2N112             43.0000   28     63.333 21.6667  93.333    149      39.000  72.333 16.3333  2.6667 53.7    2.93   1.34   615
114 2N113             42.0000   33    118.667 28.0000 115.000    147      39.667 105.333 17.3333  2.3333 38.5    4.19   1.71   351
115 2N114             44.0000   27     62.000 23.3333 109.000    145      43.667  88.333 18.0000  2.6667   48    2.79   1.28   681
116 2N115                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
117 2N116             42.0000   25     96.000 32.3333 108.000    142      57.667 124.333 18.6667  3.3333 46.6    2.98    1.9   604
118 2N117             44.0000   28     35.000 12.0000  91.000    140      40.867  77.000 11.6667  2.0000 53.3    2.92   1.03  1142
119 2N118             44.0000   28     39.667 20.6667  78.667    136      63.333 110.667 16.0000  4.6667 54.9    2.13   1.41  1573
120 2N119             42.0000   26     60.000 20.0000  88.000    135      45.467  85.000 17.0000  2.6667 53.7    2.97   1.21   745
121 2N120             45.0000   27     96.667 41.6667  84.000    131      70.233 101.667 22.6667  4.3333 65.7    2.21   2.05   767
122 2N121             24.0000   29     85.667 33.6667  92.000    124      60.033 103.333 22.0000  4.6667 54.6    2.46   1.57   649
123 2N122             22.0000   31    135.250 49.5000  81.000    149      93.250 187.000 27.7500  4.7500 46.6    2.77   1.65   834
124 2N123             22.0000   32     20.667 10.3333  79.000    147      26.533  63.000  6.3333  2.6667 44.7    1.95    1.8  1231
125 2N124             22.0000   25     90.000 37.3333  77.333    123      38.700  66.000 21.0000  2.6667 57.9    2.42   1.85   421
126 2N125             42.0000   31    151.000 53.3333  77.333    123      49.167  88.333 27.6667  4.3333 53.6    3.01   2.05   336
127 2N126             43.0000   29     30.000 15.0000  67.667    142      32.333  75.000 10.3333  4.0000   46    2.06   1.45  1156
128 2N127             43.0000   29     60.333 16.6667  72.333    140      16.900  43.667 12.0000  3.6667 41.1    3.59   1.41   397
129 2N128             41.0000   28     78.000 24.0000 108.000    136      39.000  70.000 14.0000  1.6667 55.3    3.63   1.69   509
130 2N129             42.0000   31     28.000 16.6667  79.667    135      23.133  79.333  9.3333  2.6667 29.5    1.55   1.85   837
131 2N130             22.0000   31    126.333 47.3333  68.667    131      75.567 160.667 33.0000  4.6667   47     2.7   1.45   596
132 2N131             20.0000   30     86.714 30.4286  75.143    136      38.086  69.000 17.7143  2.4286 54.2    2.79   1.71   435
133 2N132                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
134 2N133             41.0000   27    124.333 67.6667  83.333    111      92.100 146.000 46.6667  7.3333 62.9     1.8   1.44   801
135 2N134             21.3333   31    216.000 78.6667  94.667    123     122.333 216.000 46.6667  5.6667 56.4    2.81   1.62   533
136 2N135             21.3333   34    100.000 37.6667  86.000    123      77.267 141.667 30.6667  4.6667 55.7    2.64   1.16   773
137 2N136             18.0000   26    223.333 74.6667  88.333    120     145.567 193.333 59.0000  8.0000 76.5    2.96   1.27   656
138 2N137             41.0000   27     61.000 19.0000  95.333    140      49.033  99.333 13.0000  3.0000 49.5    3.34   1.49   832
139 2N138             42.0000   26     71.667 27.0000  78.333    136      77.267 139.333 23.6667  4.3333 52.8    2.54    1.1  1101
140 2N139             18.0000   28    166.667 64.3333 101.667    124     119.733 218.333 35.3333  6.6667 55.2    2.58    1.9   712
141 2N140             18.0000   24    116.667 39.3333  92.667    124      77.700 149.667 26.0000  4.3333   53    3.04   1.48   658
142 2N141             22.0000   27    162.000 59.3333  95.667    124      89.400 167.000 37.0000  5.0000 51.7     2.7   1.58   566
143 2N142                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
144 2N143                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
145 2N144             18.0000   36     75.000 41.0000  57.000    107      51.800 102.000 28.0000 10.0000 50.8    1.83   1.46   691
146 2N145             45.0000   33      0.000  1.0000  35.000    143       0.000  12.000  0.0000  1.0000 0.00    .000      .     .
147 2N146             42.0000   32     34.000 20.0000  64.000    142      18.400  44.000 14.0000  7.0000 41.8     1.7   1.43   541
148 2N147             34.0000   28     79.000 35.0000  80.000    140      89.900 162.000 26.0000  7.0000 55.5    2.26   1.35  1138
149 2N148             34.0000   28     24.000 14.0000  75.000    140      21.600 107.000 20.0000  2.0000 20.2    1.71   .700   900
150 2N149             18.0000   29     96.000 43.0000  60.000    107     103.400 174.000 33.0000  7.0000 59.4    2.23    1.3  1077
151 2N150                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
152 2N151             22.0000   26     59.333 26.0000  64.667    111      67.567 118.000 20.6667  5.3333 60.6    2.16   1.26  1213
153 2N152                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
154 2N153             43.0000   29     39.000 18.0000  53.000    147      47.000  92.000 14.0000  3.0000 51.1    2.17   1.29  1205
155 2N154                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
156 2N155             18.0000   35     72.000 26.6667  79.333    123      44.733  85.667 18.6667  3.6667 51.1     2.5   1.42   618
157 2N156             42.0000   26     66.000 24.6667  87.667    142      49.467 105.333 23.3333  3.3333 46.2    2.66   1.03   957
158 2N157             26.0000   32    123.333 53.0000  81.667    140     121.767 241.333 36.6667  8.0000 46.2    2.11    1.4   987
159 2N158             18.0000   31    100.000 36.5000  69.000    124      59.950 147.500 25.0000  5.5000 39.2    2.34   1.29   722
160 2N159             18.0000   30    153.500 61.0000  61.500    107      15.450 254.000 41.5000 12.0000 6.27    2.47   1.47   102
161 2N160             47.0000   28          .       .       .      .           .       .       .       .    .       .      .     .
162 2N161                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
163 2N162             24.0000   28     45.000 23.0000  54.000    149      92.000 257.000 18.0000  8.0000 35.8    1.96   1.28  2044
164 2N163                   .    .          .       .       .      .           .       .       .       .    .       .      .     .
165 2N164             28.0000   30    269.000 80.3333  95.333    145     128.467 234.667 57.0000  6.0000 51.4    3.48   1.39   451
166 2N165             20.0000   28     90.000 45.0000  55.000    112     121.200 198.000 32.0000 13.0000 61.2       2   1.41  1347
167 2N166             24.0000   25    103.000 39.0000  68.000    112     167.800 335.000 25.0000  6.0000 50.1    2.64   1.56  1629
168 2N167             47.0000   33     26.000 15.0000  80.000    140      18.800 130.000 15.0000  5.0000 14.5    1.73      1   723
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OBS ACCNBR     EMERG  FLOWER   SEEDS    PODS    HEIGHT  MATURITY   YIELD     TDM    NODES    STALKS    HI  SEEDSPOD PPNODE MKWT

169 2N168    22.0000   34.0    9.000  4.0000   37.000     112      10.200  16.000  3.0000   1.0000 63.7    2.25    1.33  1133
170 2N169    18.0000   23.0   72.000 39.0000   61.000     113      43.200  90.000 25.0000   7.0000   48    1.85    1.56   600
171 2N170    23.0000   23.0   42.000 43.0000   46.000     134      36.000 178.000 36.0000  36.0000 20.2    .977    1.19   857
172 2N171          .      .        .       .        .       .           .       .       .        .    .       .       .     .
173 2N172    34.0000   22.0   25.000 21.0000   53.000     111      49.800  78.000 18.0000   6.0000 63.8    1.19    1.17  1992
174 2N173    28.0000   36.0   72.000 62.0000   50.000     147      21.500  40.000 40.0000  10.0000 53.7    1.16    1.55   299
175 2N174    30.0000   22.0   46.000 19.0000   45.000     107      66.000 132.000 14.0000   1.0000   50    2.42    1.36  1435
176 2N175    46.0000   30.0   30.000 22.0000   60.000     123      24.100  44.000 14.0000   5.0000 54.8    1.36    1.57   803
177 2N176          .      .        .       .        .       .           .       .       .        .    .       .       .     .
178 2N177          .      .        .       .        .       .           .       .       .        .    .       .       .     .
179 2N178    46.0000   30.0    7.000  2.0000   63.000     123       9.000  30.000  2.0000   1.0000   30     3.5       1  1286
180 2N179    24.0000   34.0   75.000 28.0000   74.000     154     141.600 270.000 27.0000   4.0000 52.4    2.68    1.04  1888
181 2N180    41.0000   19.0   61.000 34.0000   58.500     134      88.500 144.000 26.0000   6.5000 61.2    1.79    1.31  1470
182 2N181    18.0000   34.0  128.000 57.0000   58.000     124     116.900 227.000 45.0000  18.0000 51.5    2.25    1.27   913
183 2N182    36.0000   27.0   78.000 21.0000   85.000     149     134.000 265.000 20.0000   4.0000 50.6    3.71    1.05  1718
184 2N183    25.0000   30.0   23.000 11.0000   77.000     147           .       .  8.0000   5.0000    .    2.09    1.38     .
185 2N184    41.0000   28.0   36.000 15.0000   80.000     145      42.000 206.000 15.0000   4.0000 20.4     2.4       1  1167
186 2N185    46.0000   25.0    8.000  5.0000   75.000     123       2.000  72.000  5.0000   2.0000 2.78     1.6       1   250
187 2N186    22.0000   31.0   87.000 29.0000   92.000     142     175.900 364.000 28.0000   7.0000 48.3       3    1.04  2022
188 2N187    22.0000   31.0   66.000 18.0000   60.000     111     101.200 128.000 10.0000   4.0000 79.1    3.67     1.8  1533
189 2N188    22.0000   35.0   39.000 19.5000   69.000     112      72.900 103.000 16.5000   6.5000 70.7    2.06    1.18  1868
190 2N189    48.0000   24.0   41.000 11.0000   90.000     123      75.500 153.000 11.0000   4.0000 49.3    3.73       1  1841
191 2N190    21.0000   31.0  109.000 30.0000   66.000     134     134.000 252.000 27.0000   8.0000 53.2    3.83    1.11  1229
192 2N191    18.0000   39.0   11.000  9.0000   61.000     111      13.600  76.000  9.0000  13.0000 17.9    1.22       1  1236
193 2N192          .      .        .       .        .       .           .       .       .        .    .       .       .     .
194 2N193          .      .        .       .        .       .           .       .       .        .    .       .       .     .
195 2N194    26.0000   31.0   39.000  9.0000   30.000     145       6.600  32.000  9.0000   4.0000 20.6    4.33       1   169
196 2N195    18.0000   34.0   84.667 33.0000   86.000     123      43.267  84.667 22.0000   3.3333 47.9    2.26    1.55   528
197 2N196    18.0000   38.0  215.667 89.3333   92.333     124      62.733 145.000 54.3333   7.0000 40.5    2.47    1.69   269
198 2N197    41.3333   29.0   62.333 20.0000   97.333     140      27.133  62.667 12.6667   1.6667 45.1    3.08     1.6   426
199 2N198    18.0000   34.0  157.667 62.0000   96.000     120      82.600 175.667 41.6667   5.3333 45.4     2.5     1.5   514
200 2N199    18.0000   23.0  114.333 44.0000   82.000     120      85.467  96.333 40.0000   7.3333 86.1    2.62     1.1   779
201 2N200    21.3333   34.0  209.333 62.6667   97.333     134     108.133 234.667 44.6667   4.6667 44.8    3.17    1.36   550
202 2N201    28.0000   24.0   67.333 32.0000   58.000     151      24.000  68.333 15.0000   4.3333 35.5    2.22    2.05   361
203 2N202    44.0000   24.0   46.000 20.3333   66.333     149      39.667  66.667 13.0000   3.0000 59.8    2.38     1.6   862
204 2N203    43.0000   26.0   60.333 22.6667  101.667     147      26.000  57.333 16.0000   2.6667 45.1    2.49    1.41   503
205 2N204    27.0000   30.0   27.000 24.3333   48.333     123      47.533  94.333 18.3333   5.0000 51.9    1.16    1.18  1587
206 2N205    44.0000   26.0   36.333 21.0000   76.333     143      49.500  95.667 15.0000   2.6667 52.6    1.77    1.41  1338
207 2N206    18.0000   30.0   23.333 10.3333   67.000     142      25.967  48.000  8.3333   4.6667 53.2    2.18    1.23  1171
208 2N207    28.0000   25.0   31.667 17.3333   61.667     140      43.100  68.667 15.0000   4.3333 61.5    1.54     1.1  1652
209 2N208    44.0000   26.0   55.667 22.6667   67.333     136      61.067  92.000 13.6667   4.6667 67.1    2.46    1.67  1097
210 2N209    42.7500   28.5   26.500 10.0000   74.000     135      38.350  63.000  7.2500   2.7500 60.4    2.73    1.31  1625
211 2N210    44.0000   29.0   58.667 22.3333   75.333     154           .       . 15.3333   3.6667    .    2.64    1.46     .
212 2N211    20.0000   26.0   56.667 25.3333   64.667     124      62.333 103.000 17.3333   5.6667 60.2     2.1    1.55  1192
213 2N212    44.0000   35.0   20.667  9.6667   77.000     149      38.000  90.667  8.0000   3.0000 42.5    2.36    1.22  1808
214 2N213    43.0000   35.0   31.667 11.6667   83.667     147      39.000  78.667  8.6667   3.3333 48.8    2.66     1.3  1382
215 2N214    22.0000   30.0   34.000 25.0000   51.667     107      24.267  77.000 18.0000   8.0000 31.6    1.39    1.41   746
216 2N215    18.0000   30.0  146.333 61.0000   67.000     120      99.200 183.000 40.6667   7.6667 57.8    2.28    1.41   773
217 2N216    24.0000   36.0   92.000 32.6667   80.000     142     115.833 230.667 24.3333   8.6667 45.5    2.47    1.23  1375
218 2N217    18.0000   33.0  108.333 42.6667  109.333     140      40.467  90.333 22.0000   1.6667 45.4     2.5    1.96   392
219 2N218    18.0000   29.0  183.667 65.3333   92.667     124      85.267 155.333 32.3333   3.0000   55    2.83    2.03   465
220 2N219    41.0000   30.0   69.000 27.3333  109.333     154      41.733 116.000 20.6667   2.6667   37    2.65    1.39   609
221 2N220    44.0000   28.0  159.000 61.3333  100.333     154      86.633 187.667 40.0000   5.3333 42.2    2.55    1.54   503
222 2N221    43.0000   32.0   79.000 40.0000   93.333     151      41.000  96.667 24.6667   5.0000 41.4    2.19    1.65   592
223 2N222    42.0000   30.0   89.000 28.6667   91.667     149      34.667  81.333 20.3333   3.0000 40.6    3.14    1.42   395
224 2N223    43.0000   30.0  133.000 45.3333  107.333     147      65.900 122.000 25.3333   3.0000 53.2    3.05    1.81   527
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OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
225	2N224	44	34	30.000	13.6667	104.000	145	15.7000	42.667	9.6667	1.3333	37.4	2.27	1.41	570
226	2N225	.	.	.	.	.	.	.	.	.	.	.	.	.	.
227	2N226	.	.	.	.	.	.	.	.	.	.	.	.	.	.
228	2N227	43	28	88.667	25.0000	105.333	140	30.5667	70.000	18.6667	2.6667	43.2	3.39	1.38	416
229	2N228	.	.	.	.	.	.	.	.	.	.	.	.	.	.
230	2N229	43	31	126.333	41.3333	105.000	135	59.1000	102.667	15.6667	1.6667	55.3	3.04	2.66	464
231	2N230	43	30	70.500	13.5000	62.500	154	73.7500	144.500	13.5000	5.5000	50.5	4.81	1	1179
232	2N231	44	30	27.000	14.0000	78.000	151	37.0000	168.000	12.3333	7.6667	25.9	1.99	1.13	1483
233	2N232	42	29	59.333	16.6667	68.333	149	58.2667	97.000	8.0000	3.0000	60.2	3.72	2.04	1080
234	2N233	43	26	66.333	35.3333	68.333	147	47.7333	93.000	20.3333	3.6667	55	2.06	1.67	702
235	2N234	38	30	46.333	23.0000	77.333	145	51.0000	89.333	11.3333	3.0000	56.5	2.03	2.05	1091
236	2N235	44	31	69.333	37.0000	67.000	143	65.7333	165.000	33.3333	7.0000	37.9	1.82	1.11	921
237	2N236	44	30	87.667	46.3333	68.000	142	40.5333	85.333	28.3333	7.0000	49.8	2.04	1.61	769
238	2N237	45	28	40.333	16.3333	80.333	140	46.3333	137.000	11.6667	3.0000	31.5	2.65	1.38	1183
239	2N238	43	26	39.000	18.0000	76.667	136	59.2667	98.000	11.3333	4.3333	61	2.17	1.65	1550
240	2N239	43	28	82.333	38.0000	59.667	120	70.2000	109.667	28.0000	6.0000	62.1	3.46	1.34	823
241	2N240	17	23	61.667	48.6667	49.667	134	33.4667	67.333	26.0000	5.6667	41.4	1.21	1.88	550
242	2N241	43	35	17.000	18.5000	61.000	151	30.5000	101.000	14.0000	11.5000	20.3	1.42	1.45	1794
243	2N242	22	28	119.000	50.5000	53.000	149	38.7000	71.000	42.5000	11.0000	45.7	2.31	1.19	272
244	2N243	26	29	104.667	45.6667	73.667	147	64.3333	120.000	29.3333	5.3333	53	2.18	1.59	691
245	2N244	43	32	.	23.0000	71.000	145	.	.	13.3333	3.0000	.	.	1.76	.
246	2N245	18	30	130.667	55.0000	83.000	123	52.5667	99.333	30.3333	6.6667	48	2.22	1.74	401
247	2N246	24	30	29.667	13.6667	57.667	142	29.1667	71.667	11.0000	5.3333	40.7	2	1.24	1145
248	2N247	19	21	53.667	24.0000	65.333	140	27.6667	49.000	16.0000	3.3333	56.1	2.18	1.48	602
249	2N248	43	28	35.667	15.6667	55.000	136	33.7667	46.000	13.3333	3.6667	73.2	2.38	1.18	944
250	2N249	44	23	13.500	10.0000	57.500	149	13.6000	81.500	9.5000	4.0000	22.8	1.32	1.05	1056
251	2N250	26	26	8.333	3.3333	63.667	151	1.8333	81.667	3.3333	3.3333	2.25	3.08	1	283
252	2N251	35	28	70.333	23.0000	70.667	151	48.7667	84.333	14.0000	4.6667	57.5	2.89	1.65	777
253	2N252	44	26	28.000	14.0000	62.667	149	44.3333	83.000	10.3333	3.6667	55	2.35	1.32	1576
254	2N253	24	39	79.333	37.3333	70.000	147	94.6667	173.000	22.3333	8.0000	54.8	2.32	1.63	1194
255	2N254	44	29	48.333	25.0000	55.667	145	58.0000	96.667	19.0000	5.3333	60.2	1.95	1.32	1200
256	2N255	43	27	35.667	10.6667	70.333	143	51.4667	89.333	8.3333	3.0000	58.6	3.51	1.19	1325
257	2N256	44	32	50.333	27.3333	67.000	142	76.4667	172.667	19.6667	8.6667	46.8	1.84	1.39	1506
258	2N257	19	30	42.000	16.0000	62.333	140	65.3333	112.000	11.6667	5.0000	56.9	2.63	1.4	1536
259	2N258	43	26	33.000	18.6667	64.333	139	62.6333	106.000	14.3333	4.6667	60	1.72	1.3	1904
260	2N259	20	35	31.667	15.3333	59.000	135	39.6667	91.333	12.0000	5.3333	36.5	1.82	1.24	1151
261	2N260	17	25	37.333	17.6667	46.000	135	37.6667	98.333	14.0000	6.0000	41.1	2.16	1.26	1050
262	2N261	45	31	18.333	16.6667	78.000	151	21.0000	67.667	12.3333	6.6667	30.2	1.12	1.39	1130
263	2N262	43	30	38.000	21.0000	77.000	149	45.1667	112.333	14.6667	4.6667	41.1	1.89	1.43	1149
264	2N263	43	29	40.333	19.0000	68.333	147	59.6667	104.333	15.3333	4.0000	54.7	2.05	1.26	1466
265	2N264	41	27	48.000	20.3333	64.000	145	41.6667	64.333	10.6667	2.6667	65.2	2.48	1.91	871
266	2N265	43	31	33.333	20.3333	67.000	143	38.6667	75.667	13.3333	5.3333	48.9	1.65	1.54	1109
267	2N266	43	28	34.333	20.3333	64.333	142	42.4333	83.667	13.6667	5.3333	48.5	1.71	1.48	1231
268	2N267	.	.	.	.	.	.	.	.	.	.	.	.	.	.
269	2N268	43	31	65.333	23.3333	73.667	136	63.5667	97.667	12.3333	5.3333	64.8	2.84	1.87	966
270	2N269	44	23	41.000	18.6667	54.667	135	40.2667	89.667	14.0000	3.6667	48.7	2.29	1.3	1089
271	2N270	43	30	44.000	13.6667	72.000	135	41.5667	74.000	12.0000	4.0000	57	3.02	1.13	1196
272	2N271	44	28	41.000	20.3333	85.000	151	29.3333	80.667	13.6667	3.3333	38.9	2.1	1.48	732
273	2N272	44	27	45.000	27.6667	66.333	149	40.0667	76.000	14.3333	3.3333	51.4	1.57	1.91	889
274	2N273	45	28	59.333	43.0000	65.000	123	67.9000	120.333	28.0000	4.6667	55	1.09	1.56	1333
275	2N274	42	29	13.333	11.3333	70.333	145	19.0000	49.000	9.6667	3.3333	39.8	1.21	1.18	1426
276	2N275	20	31	21.333	12.0000	69.667	143	27.4333	47.333	8.6667	3.3333	57.1	2.04	1.37	1217
277	2N276	44	27	68.667	35.0000	83.333	142	58.5333	103.333	24.3333	4.0000	56.6	1.95	1.44	869
278	2N277	45	25	36.667	16.0000	67.667	140	56.0333	99.667	11.0000	4.0000	55.8	2.31	1.49	1571
279	2N278	45	26	31.667	16.6667	63.333	139	32.6667	51.667	10.6667	3.6667	63	1.87	1.57	1028
280	2N279	44	30	69.000	30.6667	72.000	135	96.5000	214.000	20.6667	5.6667	45	2.18	1.44	1530

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
281	2N280	45	31	53.667	24.6667	71.3333	135.000	49.300	94.000	18.0000	4.6667	51.9	2.16	1.38	924
282	2N281	44	26	32.333	16.0000	58.0000	124.000	30.733	78.667	11.0000	4.6667	38.7	2.13	1.56	988
283	2N282	44	28	35.000	14.3333	67.3333	149.000	31.967	58.333	9.3333	3.3333	52.6	2.42	1.75	881
284	2N283	42	33	44.333	12.3333	48.0000	102.667	40.633	90.667	11.3333	6.0000	46.1	7.98	1.07	867
285	2N284	42	28	40.667	12.3333	87.6667	145.000	46.333	80.667	9.3333	2.6667	57.4	3.24	1.32	1176
286	2N285	45	24	42.667	17.0000	68.0000	143.000	53.300	102.000	15.0000	3.0000	54.3	2.72	1.12	1273
287	2N286	42	25	46.667	17.0000	81.3333	142.000	56.667	92.000	13.6667	3.3333	63.8	2.77	1.18	1337
288	2N287	26	30	36.667	20.6667	68.3333	140.000	43.000	86.333	12.3333	5.0000	44.1	1.73	1.69	1043
289	2N288	40	25	23.667	10.3333	66.6667	139.000	23.367	37.333	9.6667	2.6667	63.6	2.28	1.07	1007
290	2N289	36	31	34.667	12.6667	57.3333	134.000	53.067	111.667	11.0000	4.6667	45.3	2.76	1.1	1572
291	2N290	20	40	5.000	2.0000	63.3333	134.000	3.433	74.000	2.0000	2.3333	4.05	2.5	1	729
292	2N291	17	30	63.000	33.6667	52.6667	107.000	41.433	76.333	21.6667	7.0000	50.3	1.79	1.57	770
293	2N292	18	30	102.333	40.6667	60.0000	107.000	49.733	77.667	24.6667	8.6667	64	2.46	1.64	492
294	2N293	17	38	75.667	34.3333	58.6667	107.000	34.833	60.333	23.0000	5.0000	57	2.22	1.49	445
295	2N294	17	26	102.333	47.6667	72.3333	107.000	51.733	79.000	30.3333	5.3333	54.8	1.96	1.58	445
296	2N295	17	28	77.000	44.0000	84.0000	112.000	53.533	109.333	25.6667	4.3333	51.5	1.86	1.72	818
297	2N296	17	23	90.667	38.0000	59.3333	112.000	55.633	86.667	21.3333	5.6667	62.5	2.62	2.04	655
298	2N297	17	25	74.000	36.3333	60.3333	120.000	50.100	87.333	19.3333	4.6667	60.4	2.43	1.94	663
299	2N298	17	29	77.667	28.3333	60.0000	120.000	58.667	125.000	24.0000	6.6667	53.2	2.74	1.16	707
300	2N299	18	28	27.333	15.0000	49.0000	135.000	15.567	36.000	11.3333	3.0000	43	1.9	1.39	567
301	2N300	18	37	80.667	35.3333	60.3333	135.000	92.433	160.333	27.3333	7.3333	59.2	2.29	1.3	1199
302	2N301	43	25	28.000	11.6667	58.3333	151.000	26.900	58.000	10.3333	3.3333	47.6	2.46	1.14	975
303	2N302	42	26	29.333	13.6667	59.0000	123.000	26.133	45.333	11.0000	3.6667	56.7	2.28	1.19	929
304	2N303	42	26	67.333	21.6667	89.0000	147.000	60.267	106.000	17.6667	4.3333	57.9	3.12	1.22	891
305	2N304	41	28	64.000	40.6667	66.0000	123.000	42.333	69.333	19.3333	3.6667	61.1	1.73	2.06	665
306	2N305	43	28	63.000	26.0000	68.3333	143.000	52.600	78.333	12.3333	2.6667	67.3	2.39	2.11	900
307	2N306	43	29	53.333	20.0000	75.3333	142.000	64.067	116.333	11.3333	4.3333	56.3	2.77	1.8	1165
308	2N307	43	28	111.667	32.6667	77.3333	140.000	85.933	138.667	17.6667	4.3333	61.6	3.22	1.8	980
309	2N308	43	29	54.667	21.6667	66.0000	139.000	41.467	57.333	13.6667	3.3333	72.8	2.51	1.6	786
310	2N309	42	29	50.000	19.5000	67.0000	135.000	43.350	69.500	11.5000	3.0000	62.9	2.71	1.68	886
311	2N310	42	28	80.667	22.0000	71.3333	134.000	41.333	132.667	17.3333	5.6667	24.2	2.74	1.14	638
312	2N311	31	33	27.000	18.0000	55.0000	151.000	32.633	96.000	15.3333	6.0000	35.7	1.4	1.25	1430
313	2N312	42	25	39.667	17.0000	65.0000	123.000	22.333	44.667	8.6667	3.3333	49.5	2.46	1.89	649
314	2N313	41	27	90.667	34.3333	72.6667	147.000	50.200	79.333	22.3333	4.6667	62.5	2.94	1.52	546
315	2N314	42	28	152.500	44.0000	70.5000	145.000	57.300	101.500	33.5000	7.0000	57.6	3.47	1.32	465
316	2N315	43	27	53.333	20.6667	53.6667	143.000	52.333	97.000	12.6667	4.0000	54.9	2.64	1.63	983
317	2N316	43	29	33.000	14.6667	89.6667	142.000	27.100	59.333	8.0000	2.0000	45.3	2.24	1.82	1039
318	2N317	43	29	88.667	26.3333	78.6667	140.000	42.233	80.667	21.0000	5.3333	47.5	3.14	1.5	518
319	2N318	44	32	27.333	13.0000	69.0000	139.000	30.900	73.333	10.3333	3.6667	45.6	2.19	1.26	1159
320	2N319	43	32	73.667	32.6667	68.6667	135.000	44.100	89.000	19.3333	4.6667	49.5	2.21	1.73	609
321	2N320	20	30	46.000	16.5000	43.5000	134.000	50.400	114.500	10.5000	5.0000	29.3	2.79	1.57	1096
322	2N321	40	28	23.000	6.3333	62.6667	146.000	45.667	58.667	6.3333	3.0000	78.3	3.71	1	1994
323	2N322	26	29	83.333	37.0000	81.0000	144.000	39.867	92.667	20.6667	4.6667	44.2	2.27	1.81	480
324	2N323	25	30	134.000	41.6667	89.3333	142.000	52.000	88.333	24.0000	4.3333	57.4	3.11	1.68	392
325	2N324	25	28	47.333	23.3333	69.3333	140.000	69.333	129.667	15.6667	6.3333	53.6	2.03	1.51	1462
326	2N325	25	31	91.667	41.0000	54.0000	138.000	84.300	158.000	29.6667	10.6667	49.6	2.25	1.36	990
327	2N326	40	27	39.000	16.0000	80.6667	137.000	56.533	108.667	12.3333	4.3333	50.4	2.35	1.27	1519
328	2N327	40	36	19.000	8.0000	65.0000	135.000	25.533	102.333	7.6667	4.0000	22.8	2.27	1.03	1278
329	2N328	42	35	70.667	35.6667	70.6667	134.000	89.767	182.000	31.3333	8.3333	50.1	2.01	1.13	1347
330	2N329	25	27	49.000	20.3333	73.6667	130.000	47.600	134.667	13.0000	7.6667	37.1	2.38	1.55	943
331	2N330	41	32	72.667	18.3333	58.6667	129.000	66.867	125.667	12.6667	4.0000	57.3	4	1.47	914
332	2N331	40	28	31.000	9.6667	63.0000	146.000	46.667	87.667	8.3333	3.0000	54.7	3.33	1.23	1464
333	2N332	25	26	37.000	14.6667	64.6667	118.000	40.533	75.333	12.3333	7.0000	52.8	2.64	1.21	1084
334	2N333	19	36	157.667	58.3333	85.6667	142.000	104.333	169.667	38.0000	8.6667	59.9	2.34	1.46	874
335	2N334	25	39	81.333	40.3333	74.6667	140.000	68.667	114.333	33.6667	11.6667	51.3	2.07	1.23	827
336	2N335	40	30	90.000	35.0000	71.6667	138.000	72.733	120.667	21.6667	6.0000	57.1	2.37	1.65	884

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OBS ACCNBR          EMERG  FLOWER   SEEDS   PODS     HEIGHT MATURITY YIELD    TDM      NODES   STALKS    HI  SEEDSPOD PPNODE MKWT

337 2N336          39.0000   35    54.333 18.0000   71.333    137    60.1000 110.000 11.6667 4.00000 56.7    3.12    1.69  1086
338 2N337          24.0000   27    42.000 14.6667   93.333    135    31.6000  55.333 10.3333 1.66667 57.2    2.85    1.46   771
339 2N338          20.0000   34    55.000 30.3333   57.333    134    66.0000 106.000 24.6667 7.33333 62.9    1.91     1.3  1201
340 2N339          19.0000   36   105.333 40.0000   74.000    130    85.7000 138.333 23.3333 5.00000 62.7    2.76    1.67   849
341 2N340          41.0000   31    52.667 32.3333   74.333    129    48.4000 122.667 21.6667 4.66667 41.5     1.6    1.52   945
342 2N341          41.0000   27    60.000 21.3333   65.000    146    45.6667  83.000 14.3333 3.33333 50.9    2.86    1.41   721
343 2N342          40.0000   28    66.667 20.6667   91.000    144    41.6667  86.333 10.6667 3.00000 44.3    3.27    1.99   613
344 2N343          40.0000   28    35.667 14.0000   77.333    142    44.7667  71.667 13.3333 3.66667 63.2     2.5    1.04  1282
345 2N344          39.0000   29    55.333 16.6667   95.000    140    39.0000  87.000 14.3333 2.66667   46    3.26    1.19   812
346 2N345          38.0000   28    32.667 12.6667   68.667    138    44.6667  82.667  8.3333 3.00000 52.9    2.55    1.53  1356
347 2N346          39.0000   29    93.333 39.0000   94.000    137    92.3333 195.000 33.3333 5.66667 44.8    2.39    1.25   982
348 2N347          39.0000   29    42.667 14.3333   72.333    135    47.0667  81.333 13.0000 4.66667 57.6    2.96     1.1  1112
349 2N348          40.0000   29    66.333 25.6667   78.000    134    53.3000  85.667 13.3333 3.33333 60.8    2.52     1.9   878
350 2N349          25.0000   25    51.333 27.3333   67.667    130    41.7000  72.333 15.3333 4.66667 57.3    1.85    1.76   840
351 2N350          41.0000   29    38.333 14.3333   67.667    129    37.7667  76.667  9.3333 2.66667 51.7    2.65    1.68  1049
352 2N351          41.0000   33    34.667 14.0000   69.667    146    44.3333 109.667 13.6667 6.66667 48.5    2.52    1.03  1306
353 2N352          39.0000   34    64.333 26.3333   83.667    144          .       . 15.0000 4.00000    .    2.37    1.73     .
354 2N353          42.0000   27    58.333 29.6667   69.333    142    50.6667  87.000 17.0000 3.66667 65.8    2.04    1.65   944
355 2N354          40.0000   27    55.667 20.3333   76.667    140    50.5000  74.667 15.0000 3.00000 67.6    2.74    1.37   918
356 2N355          39.0000   30    55.667 17.3333   83.667    138    28.0000  61.667 15.6667 3.00000 44.9    3.28    1.17   501
357 2N356          40.0000   27    48.667 19.0000   88.333    137    38.9000  81.333 10.6667 2.66667 47.4    2.58    1.73   798
358 2N357          40.0000   27    85.000 30.0000   75.333    135    90.0667 132.000 19.3333 4.66667 68.6    2.78    1.58  1114
359 2N358          40.0000   32    25.000 11.6667   68.667    134    39.4000  85.333  9.0000 4.66667 43.3    2.11    1.32  1527
360 2N359          40.0000   16    32.667 14.3333   58.333    130    30.5333  49.667 10.6667 3.66667 61.8    2.31    1.36   986
361 2N360          42.0000   38    70.667 27.0000   77.333    129    53.2667 179.000 21.6667 6.33333 34.9    2.75    1.26   753
362 2N361          41.0000   39    12.000 12.3333   65.667    146    17.2000  96.667  9.0000 3.66667 19.4    .983    1.43  1594
363 2N362          40.0000   33    24.667 12.3333   64.333    144    25.6667  66.000  7.6667 4.33333 38.2       2    1.65  1003
364 2N363          41.0000   35    16.000 14.0000  117.000    118    16.3000 236.000 14.0000 4.00000 6.91    1.14       1  1019
365 2N364          41.0000   35    20.000  9.6667   79.333    140    28.9000 129.333  8.0000 3.00000 21.3    1.53    1.09  1475
366 2N365          42.0000   30    48.000 18.0000   65.667    138    36.4000  64.667 11.0000 3.33333 56.1    2.75    1.62   770
367 2N366          42.0000   29    31.667 12.6667   66.667    137    42.1667  78.667  8.3333 2.66667 55.1    2.44    1.58  1408
368 2N367          39.0000   31    36.000 18.3333   67.000    135    42.2667  72.667 12.3333 3.66667 58.3    2.04    1.52  1179
369 2N368          40.0000   36    29.667 11.3333   85.667    134    31.8000 104.333 11.0000 5.66667 30.6    2.62    1.03  1067
370 2N369          38.0000   26    28.000 13.0000   64.333    129    39.4333  67.667  9.3333 2.66667 58.7    2.24    1.37  1416
371 2N370          38.0000   25    56.667 21.3333   58.333    129    48.5667  72.667 12.3333 3.33333 66.9    2.71     1.8   868
372 2N371          24.0000   20    43.500 20.0000   66.500    119    22.2500  37.500 11.5000 3.50000 59.5    2.21    1.75   493
373 2N372          40.0000   28    77.667 24.0000   78.333    144    48.0000  90.667 16.3333 3.66667 53.1    3.31    1.44   629
374 2N373          41.0000   25    29.667 16.6667   56.000    118    38.2333  68.333 11.6667 3.66667 54.4    1.75    1.38  1333
375 2N374          38.0000   28    96.333 32.3333   73.000    118    44.8333  74.333 23.3333 5.00000 63.5    2.76    1.64   517
376 2N375          41.0000   30    43.500 19.0000   74.000    138    74.5500 210.500 16.0000 6.00000   36    2.23     1.2  1632
377 2N376          21.6667   24     9.000  9.6667   70.000    137    15.5667  69.667  7.6667 3.00000 25.7    1.32    1.23  1690
378 2N377          38.0000   29    47.333 19.0000   73.667    135    58.7667  92.000 12.6667 3.66667 63.6    2.58    1.51  1377
379 2N378          40.0000   28    23.333 10.0000   64.333    134    28.9333  81.667  8.0000 3.00000 34.6    1.95    1.19  1315
380 2N379          21.0000   19    89.333 39.0000   95.000    129    79.0000 163.667 23.0000 3.33333 46.8    2.29    1.69   958
381 2N380          40.0000   28    50.667 17.3333   72.000    129    44.0000  71.667 12.3333 2.66667   62     3.1     1.5   864
382 2N381          41.0000   24    45.000 28.6667   71.333    119    58.5667 112.667 18.3333 7.00000 44.5    1.84    1.61  1239
383 2N382          39.0000   26    61.000 26.3333   64.000    118    33.2333  56.667 15.3333 6.00000 58.7     2.3    1.79   560
384 2N383          41.0000   28    60.333 28.3333   57.667    142    33.6667  59.667 16.0000 3.33333 53.4    2.13    1.84   513
385 2N384          37.0000   29    54.333 21.3333   74.333    118    47.9000  86.000 15.0000 4.33333 55.9    2.64    1.47   864
386 2N385          38.0000   27   132.667 41.6667   78.000    138    78.6333 129.333 24.6667 5.00000 63.3    3.08     1.7   583
387 2N386          38.0000   29    80.000 35.0000   81.667    137    49.8333  91.333 16.0000 3.33333 54.9     2.3    2.16   637
388 2N387          38.0000   29    39.667 16.6667   69.667    119    33.2667  56.667  8.3333 3.33333 58.8    2.37    2.11   879
389 2N388          39.0000   29    41.333 15.6667   79.333    134    44.5000  73.667 12.3333 3.00000 61.6    2.61    1.27  1063
390 2N389          39.0000   27    54.000 18.3333   77.667    129    31.8333  54.667 10.6667 2.00000 57.3    3.05    1.68   617
391 2N390          39.0000   30    39.000 16.6667   81.667    129    32.3333  55.667  9.6667 3.00000 56.7    2.33    1.73   829
392 2N391          39.0000   28   118.333 45.0000   95.333    146    80.5667 153.667 33.3333 5.00000 52.7    2.58    1.39   725
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OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
393	2N392	39	32	75.333	22.0000	79.333	143.333	43.2667	71.333	9.3333	2.66667	58.6	3.23	2.39	655
394	2N393	39	28	58.000	22.6667	64.333	142.000	53.0000	84.000	15.0000	4.00000	63.9	2.75	1.56	958
395	2N394	39	27	48.333	20.6667	85.333	118.000	39.4333	76.000	15.3333	4.00000	51.8	2.4	1.34	815
396	2N395	38	28	43.667	16.6667	81.000	138.000	39.8333	70.000	11.0000	3.33333	57.4	2.62	1.62	936
397	2N396	38	31	94.667	30.6667	81.667	137.000	69.6667	108.333	19.0000	4.33333	61.8	2.94	1.62	748
398	2N397	18	27	27.667	12.0000	68.667	135.000	21.3333	40.333	8.0000	2.66667	56.9	2.42	1.71	750
399	2N398	39	28	44.333	14.6667	77.333	134.000	46.2333	81.000	11.0000	2.33333	57.2	3.06	1.34	1038
400	2N399	39	25	48.333	25.0000	80.000	129.000	39.0667	71.667	12.3333	3.00000	55.4	1.88	2.02	902
401	2N400	40	28	39.000	22.0000	61.333	129.000	35.5000	59.000	15.0000	5.00000	60.3	1.75	1.47	961
402	2N401	40	28	30.000	20.6667	84.000	146.000	38.5667	88.667	16.3333	5.33333	42.8	1.37	1.25	1502
403	2N402	39	28	62.333	28.3333	92.333	144.000	45.0000	87.667	17.6667	3.33333	50.8	2.2	1.65	718
404	2N403	39	26	55.667	20.3333	65.667	118.000	32.1333	59.333	15.3333	2.66667	53.6	2.74	1.31	573
405	2N404	38	28	77.667	37.3333	72.667	118.000	55.0333	116.333	24.0000	5.66667	46.5	2.1	1.54	654
406	2N405	40	26	50.000	21.6667	57.667	138.000	32.0667	54.333	10.3333	2.00000	58.9	2.32	2.11	638
407	2N406	38	30	48.667	25.3333	69.667	119.000	40.3000	78.333	21.0000	5.00000	51.1	1.95	1.22	815
408	2N407	18	22	75.667	25.6667	69.000	135.000	43.6667	82.000	16.6667	4.66667	56	2.77	1.59	635
409	2N408	38	28	89.667	38.6667	74.333	134.000	59.6000	114.333	19.6667	4.33333	52.9	2.37	1.95	676
410	2N409	38	26	56.333	20.6667	63.000	129.000	51.3333	90.000	13.0000	3.00000	56.1	2.78	1.6	862
411	2N410	39	26	54.000	26.0000	63.333	129.000	26.6000	64.333	18.0000	4.66667	43.1	2.07	1.54	496
412	2N411	19	19	81.667	45.0000	74.333	146.000	71.3333	119.667	22.6667	4.66667	59.7	1.68	2.13	1756
413	2N412	18	24	53.000	25.6667	64.333	144.000	42.0333	66.667	20.3333	5.33333	60.5	2.16	1.28	747
414	2N413	18	20	36.333	20.6667	51.667	106.000	22.2333	44.667	15.0000	4.33333	51.3	1.84	1.45	630
415	2N414	18	20	48.333	19.6667	59.667	106.000	42.5667	62.667	13.6667	5.66667	68.4	2.48	1.45	893
416	2N415	19	19	71.667	34.6667	59.333	107.000	57.5667	89.000	25.0000	8.33333	64.3	2.09	1.39	807
417	2N416	38	26	114.000	22.3333	62.667	119.000	30.2333	53.667	17.3333	3.33333	55.9	5.17	1.29	270
418	2N417	19	30	44.000	17.6667	80.000	135.000	37.2333	81.667	12.6667	4.33333	44.8	2.43	1.46	885
419	2N418	18	21	63.000	23.3333	48.333	134.000	34.7000	63.333	15.3333	4.00000	52.9	2.42	1.57	919
420	2N419	18	22	75.667	32.3333	60.667	115.000	64.6333	105.000	24.0000	7.66667	58.1	2.32	1.5	887
421	2N420	19	32	72.000	27.0000	71.000	115.000	58.5000	159.000	21.0000	6.00000	38.7	2.59	1.27	889
422	2N421	38	27	106.000	40.0000	80.667	146.000	75.5667	122.333	22.3333	4.33333	62.3	2.65	1.8	728
423	2N422	40	25	58.333	23.6667	68.000	106.000	37.4000	55.333	14.6667	4.66667	68.1	2.54	1.63	644
424	2N423	39	27	72.000	24.6667	67.000	142.000	41.3333	76.333	13.6667	4.00000	48.9	2.74	1.64	722
425	2N424	38	29	75.000	23.6667	68.000	140.000	38.6667	54.000	15.0000	4.00000	71.3	3.2	1.58	513
426	2N425	38	25	70.000	27.6667	59.667	138.000	49.2667	74.333	18.3333	3.66667	65.8	2.56	1.5	700
427	2N426	38	27	43.333	20.3333	65.000	137.000	30.6333	72.333	16.6667	5.33333	41.6	2.2	1.22	702
428	2N427	39	27	84.667	33.3333	66.333	135.000	61.6333	88.667	19.6667	4.33333	69.4	2.54	1.71	727
429	2N428	38	28	57.667	26.6667	67.000	134.000	50.8333	83.000	20.6667	4.66667	63	2.09	1.34	898
430	2N429	39	27	67.333	26.0000	64.000	129.000	49.1000	77.667	12.6667	3.66667	65.3	2.62	2.06	732
431	2N430	41	30	27.667	13.0000	51.667	130.000	18.8667	51.000	10.6667	3.00000	41.5	2.05	1.22	639
432	2N431	39	27	46.333	23.3333	70.000	146.000	33.7667	73.667	12.6667	4.00000	46.6	2.12	1.85	745
433	2N432	40	28	39.667	20.0000	75.667	144.000	53.0000	76.333	13.6667	3.00000	70.7	2.17	1.5	1255
434	2N433	38	28	50.333	18.3333	67.000	142.000	28.8333	54.000	12.6667	3.66667	54.3	2.86	1.44	594
435	2N434	38	29	100.000	36.0000	71.667	140.000	72.7000	106.000	21.0000	4.00000	68.4	2.61	1.74	752
436	2N435	28	32	63.333	24.6667	59.000	138.000	41.5333	74.333	16.0000	4.66667	55.5	2.5	1.53	678
437	2N436	38	26	66.667	22.3333	105.000	137.000	38.9667	83.000	13.6667	2.00000	46.2	2.93	1.71	590
438	2N437	39	29	73.000	32.6667	77.000	135.000	53.7667	87.000	16.3333	3.00000	62.4	2.27	1.96	815
439	2N438	38	30	20.000	8.3333	58.667	134.000	19.0000	62.000	6.6667	2.66667	34.1	4.95	1.19	1113
440	2N439	40	39	38.667	20.3333	89.000	129.000	19.5000	77.333	13.0000	4.33333	24.7	2.09	1.56	544
441	2N440	42	38	127.000	55.0000	60.000	130.000	86.3000	158.000	30.0000	9.00000	54.6	2.31	1.83	680
442	2N441	40	26	86.000	42.0000	88.667	146.000	70.6667	174.667	22.0000	4.00000	40.4	2.32	1.93	829
443	2N442	40	29	64.000	30.0000	67.667	144.000	30.3333	83.000	19.6667	5.33333	42.1	2.16	1.53	470
444	2N443	39	33	67.333	25.3333	77.667	142.000	38.0000	90.333	13.6667	4.00000	40.4	2.69	1.81	639
445	2N444	24	30	36.000	14.0000	76.667	140.000	22.3333	60.000	10.0000	3.33333	36.7	2.72	1.54	628
446	2N445	25	31	65.667	35.0000	62.333	118.000	54.4333	96.667	24.0000	5.66667	57.3	2.14	1.52	826
447	2N446	39	25	105.000	37.6667	60.667	119.000	39.0000	81.333	28.3333	7.66667	51.1	2.79	1.37	367
448	2N447	40	29	42.667	12.6667	76.667	135.000	51.2667	111.000	11.6667	4.33333	42.2	2.98	1.19	1232

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
449	2N448	41	25	65.000	24.0000	56.667	134	41.000	84.333	12.0000	3.0000	44.3	2.95	1.99	544
450	2N449	40	27	40.667	14.6667	62.333	129	34.367	61.667	11.0000	3.0000	55.1	2.73	1.34	852
451	2N450	39	32	56.333	17.0000	64.667	130	30.667	62.333	13.3333	5.6667	51.7	3.33	1.33	535
452	2N451	20	30	26.500	11.5000	57.500	146	14.000	92.500	11.0000	7.0000	16.4	2.9	1.03	518
453	2N452	40	26	66.667	23.3333	67.667	144	24.100	50.667	17.3333	4.0000	46.9	2.62	1.36	475
454	2N453	19	25	106.667	36.0000	87.667	142	48.600	84.667	18.3333	3.6667	55.1	2.92	1.99	438
455	2N454	18	19	60.000	32.0000	69.667	102	23.100	93.000	26.6667	10.0000	24.3	2.05	1.18	378
456	2N455	40	31	134.667	65.6667	52.333	118	45.700	87.667	55.3333	14.0000	52.9	2.03	1.32	431
457	2N456	39	26	31.333	13.0000	60.333	119	47.633	74.000	10.0000	3.0000	63.8	2.34	1.38	1403
458	2N457	38	27	23.000	14.6667	63.667	135	22.300	42.667	10.3333	2.6667	52	1.57	1.49	953
459	2N458	40	29	25.333	12.3333	60.333	134	26.700	77.667	9.0000	4.3333	34.2	1.97	1.36	1154
460	2N459	40	26	140.000	44.0000	85.000	129	84.600	168.000	27.0000	3.0000	50.4	3.18	1.63	604
461	2N460	27	33	93.667	37.0000	71.333	129	30.833	81.333	19.6667	2.6667	33.6	2.26	1.72	388
462	2N461	39	26	56.000	23.0000	87.333	146	29.000	97.333	13.6667	2.3333	29.6	2.31	1.57	501
463	2N462	40	27	66.667	28.3333	81.000	144	32.667	69.333	15.3333	2.6667	39.4	2.44	2.16	427
464	2N463	39	28	67.000	23.3333	90.000	142	35.133	63.667	16.3333	2.0000	55.4	2.86	1.44	548
465	2N464	39	33	145.000	46.3333	93.333	140	104.000	200.333	29.3333	7.3333	49	3.04	1.53	735
466	2N465	40	27	101.000	38.6667	82.000	138	37.600	77.000	26.6667	3.6667	49.2	2.61	1.55	374
467	2N466	25	24	59.000	18.3333	65.667	115	75.000	99.667	17.3333	4.3333	76.8	3.13	1.05	1296
468	2N467	25	28	47.333	12.0000	91.667	135	51.500	92.000	10.3333	3.0000	53.7	3.67	1.15	1240
469	2N468	38	27	63.500	19.7500	79.250	134	61.500	99.250	16.7500	4.7500	57.7	2.97	1.11	1193
470	2N469	39	27	.	25.5000	83.000	129	.	.	12.5000	1.5000	.	.	1.98	.
471	2N470	40	30	92.333	31.6667	97.000	129	68.633	132.000	22.6667	3.3333	51.4	2.9	1.45	748
472	2N471	39	27	108.333	38.3333	90.000	146	69.900	137.000	23.0000	4.3333	50.7	2.84	1.78	686
473	2N472	39	29	90.000	31.6667	91.667	144	56.000	109.000	22.6667	3.6667	53	3.07	1.36	640
474	2N473	39	27	59.000	19.6667	111.000	142	39.000	78.000	16.6667	2.0000	50.2	2.99	1.19	678
475	2N474	39	29	85.333	29.6667	109.000	140	53.333	111.667	22.0000	3.0000	47.6	3.08	1.36	611
476	2N475	40	27	51.000	19.6667	96.333	138	45.867	98.667	15.6667	3.0000	45.9	2.61	1.26	882
477	2N476	41	26	62.333	22.6667	96.333	137	55.100	99.000	16.0000	3.0000	56.8	3.09	1.6	892
478	2N477	40	29	78.333	24.0000	100.000	135	62.067	116.667	17.0000	2.3333	53.1	3.22	1.41	794
479	2N478	19	32	44.667	15.3333	90.000	134	34.000	63.000	13.0000	2.6667	53.6	2.86	1.22	778
480	2N479	38	28	53.667	17.3333	102.000	129	39.500	81.000	14.0000	2.3333	50.4	3.11	1.24	741
481	2N480	19	26	82.000	34.3333	88.333	119	62.133	111.000	28.0000	4.0000	55.7	2.33	1.26	784
482	2N481	39	29	132.333	41.6667	92.333	146	74.333	140.333	28.3333	3.6667	53	3.07	1.45	607
483	2N482	39	31	72.333	25.0000	97.333	144	40.333	81.000	18.0000	3.0000	54.8	3.09	1.46	548
484	2N483	39	28	64.000	27.0000	110.667	142	50.733	96.667	18.3333	2.0000	52.4	2.37	1.5	804
485	2N484	40	29	134.333	47.3333	105.667	140	75.000	152.333	29.6667	3.0000	49.6	3.04	1.57	559
486	2N485	41	28	79.000	29.3333	100.000	138	54.333	113.000	19.3333	2.6667	48.3	2.76	1.55	678
487	2N486	42	31	.	27.6667	96.667	137	.	.	21.6667	3.0000	.	.	1.22	.
488	2N487	38	31	74.000	27.3333	96.000	135	49.633	96.000	16.6667	2.6667	50.4	2.58	1.57	709
489	2N488	41	27	97.000	33.3333	101.333	134	59.333	128.333	24.6667	4.6667	46.8	2.97	1.37	598
490	2N489	42	29	74.667	27.6667	91.333	130	40.600	72.667	22.6667	3.3333	54.9	2.77	1.24	566
491	2N490	42	34	38.667	12.6667	98.000	130	35.633	68.333	11.0000	2.0000	52.4	3.12	1.15	923
492	2N491	39	28	102.333	34.0000	97.333	146	91.667	165.333	26.6667	5.0000	51.9	2.81	1.26	891
493	2N492	19	24	145.000	45.6667	95.333	118	95.967	168.000	35.3333	5.6667	57.6	3.19	1.32	669
494	2N493	19	25	99.333	34.3333	104.333	142	66.000	126.667	25.0000	4.0000	52.7	2.97	1.32	655
495	2N494	19	37	191.000	46.0000	85.333	140	55.333	109.333	34.0000	4.3333	49.6	3.83	1.35	285
496	2N495	19	35	130.000	43.0000	101.000	138	71.000	181.667	26.3333	3.3333	39.5	3.18	1.62	539
497	2N496	19	31	61.667	40.0000	98.333	137	42.667	69.000	27.3333	3.3333	62.7	1.67	1.55	719
498	2N497	19	26	79.667	36.0000	95.000	115	56.567	99.000	25.3333	4.0000	56.9	2.18	1.44	696
499	2N498	19	34	107.667	49.0000	100.333	134	99.333	187.333	39.6667	4.3333	51.6	2.11	1.23	1182
500	2N499	19	33	73.333	32.0000	93.333	129	65.500	116.333	24.0000	3.0000	55.4	2.43	1.27	877
501	2N500	26	25	131.500	45.5000	91.500	129	95.450	194.000	35.0000	5.0000	48.9	3.39	1.31	705
502	2N501	40	26	57.667	19.0000	108.667	146	41.167	102.000	17.0000	3.3333	42	3.08	1.11	710
503	2N502	38	28	56.000	20.3333	95.333	144	56.233	117.000	14.0000	3.0000	47.2	2.72	1.68	963
504	2N503	40	29	92.000	29.6667	110.333	142	62.000	122.667	23.0000	3.0000	50.4	3.09	1.31	676

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OBS ACCNBR                 EMERG   FLOWER  SEEDS   PODS     HEIGHT  MATURITY  YIELD   TDM      NODES   STALKS    HI  SEEDSPOD PPNODE MKWT

505 2N504                 40.0000    26     83.667 32.0000  99.000    140     56.100 110.667 22.6667 2.33333 50.5   2.75     1.4    656
506 2N505                 39.0000    27     62.667 24.6667  88.333    138     52.667 102.333 16.0000 3.00000 53.9   2.62     1.57   854
507 2N506                 40.0000    28     62.667 23.3333  84.000    137     40.667  70.333 14.6667 2.66667   59   2.71     1.59   661
508 2N507                 39.0000    29     58.333 24.0000  98.333    135     47.667  85.333 14.6667 2.33333 56.3   2.54     1.62   818
509 2N508                 21.0000    34     35.667 24.6667  86.000    134     53.333 104.000 17.0000 2.66667 51.5   1.56     1.43  1488
510 2N509                 40.0000    27     93.000 34.6667 102.000    130     54.733 107.667 22.6667 2.33333 49.8   2.76     1.52   581
511 2N510                 40.0000    14    106.333 37.6667 102.667    130     55.167 113.333 27.6667 3.33333 48.4   2.82     1.32   555
512 2N511                 41.0000    29    121.333 35.3333 115.000    146     70.000 153.000 28.0000 4.00000 47.8   3.46     1.29   579
513 2N512                 41.0000    30     53.000 18.3333 103.000    144     35.667  82.333 14.0000 2.33333 43.9   2.95     1.3    661
514 2N513                 40.0000    28    118.000 33.3333 104.000    142     51.000 115.667 20.0000 3.33333 44.8   3.67     1.66   459
515 2N514                 40.0000    26     77.333 25.6667 106.000    140     52.000 101.667 18.3333 4.00000 50.7   3.04     1.39   665
516 2N515                 41.3333    28     68.333 22.3333 107.000    138     45.833 102.000 18.6667 2.66667 43.7   3.01     1.16   708
517 2N516                 40.0000    27     76.667 29.0000  94.667    137     57.400 119.000 25.3333 3.33333 48.8   2.68     1.15   750
518 2N517                 40.0000    28     61.000 19.3333  98.333    135     43.933 101.000 17.6667 2.33333 42.1   3.69     1.09   694
519 2N518                 40.0000    38     92.667 42.0000  89.000    134     47.000 129.000 23.3333 3.00000 36.7   2.21     2.03   537
520 2N519                 40.0000    33     96.667 32.6667 113.667    130     70.300 147.667 25.6667 3.00000 47.7   3.03     1.27   758
521 2N520                 20.0000    30     67.000 25.6667  79.667    130     44.833  93.333 19.0000 3.66667 48.4   2.61     1.35   668
522 2N521                 40.0000    28     88.333 29.3333  81.667    146     38.633  82.333 16.6667 3.33333 46.1   3.05     1.75   432
523 2N522                 40.0000    26     60.667 21.0000 100.667    144     38.333  84.333 14.6667 2.66667 45.6    2.9     1.48   660
524 2N523                 39.0000    29     83.333 26.3333  96.667    142     51.267  95.333 18.0000 3.00000 55.5   3.16     1.5    622
525 2N524                 39.0000    28    112.000 31.6667  97.000    140     74.767 129.000 24.0000 3.66667   58   3.13     1.29   898
526 2N525                 23.0000    33     90.667 32.6667  89.000    138     61.567 110.000 24.6667 2.66667 56.1   2.84     1.32   740
527 2N526                 40.0000    28     53.000 21.0000  80.000    137     42.900  83.333 16.0000 2.00000 51.6   2.59     1.31   821
528 2N527                 39.0000    19     89.000 28.3333  94.667    135     66.067 125.333 20.0000 3.00000 52.5   3.24     1.33   814
529 2N528                    .        .        .       .        .        .        .       .       .       .       .      .        .      .
530 2N529                 40.0000    28     57.667 23.0000  90.333    130     47.733  95.000 17.6667 2.33333 50.6   2.64     1.34   810
531 2N530                 42.0000    31     99.667 28.6667  87.667    129     54.900 115.667 24.0000 4.00000 48.1   3.48     1.21   545
532 2N531                 19.0000    32     88.333 34.3333  96.000    146     60.000 120.667 24.0000 4.66667 47.6   2.56     1.38   702
533 2N532                 39.0000    28     88.667 26.6667  91.667    144     50.767  94.000 17.0000 2.00000 53.1   3.33     1.55   601
534 2N533                 19.0000    30    162.667 61.3333 101.000    142    129.900 235.333 46.6667 5.33333 53.3   2.72     1.27   766
535 2N534                 19.0000    30    126.333 44.3333 100.667    140     92.700 180.667 29.6667 4.00000 53.2   3.18     1.56   774
536 2N535                 25.0000    25    108.000 35.0000  96.667    138     69.333 144.667 27.3333 4.00000 47.9    3.1     1.29   640
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OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
2	2N001	32.0000	34	50.333	18.0000	101.333	117.000	15.5000	47.333	10.6667	2.33333	34	2.88	1.9	327
3	2N002	32.0000	34	73.333	37.6667	99.000	113.000	21.9000	64.333	18.0000	2.33333	33.7	1.96	2.07	298
4	2N003	25.0000	39	58.000	18.6667	73.333	112.000	12.3667	28.000	9.3333	2.00000	42	3.12	2.02	211
5	2N004	32.0000	36	31.000	16.0000	74.667	110.000	3.7333	13.667	10.0000	3.66667	25.7	1.77	1.59	98
6	2N005	29.0000	29	53.000	20.3333	87.667	107.000	22.2000	57.333	11.6667	3.33333	40.8	2.71	1.72	427
7	2N006	32.0000	32	75.333	26.0000	100.333	106.000	19.6333	51.000	11.6667	2.66667	36.8	2.9	2.43	281
8	2N007	24.0000	36	62.333	24.0000	107.000	105.000	14.1333	61.667	11.0000	3.00000	23.3	2.63	2.29	228
9	2N008	18.0000	42	63.667	32.0000	119.000	117.000	23.9667	64.333	15.3333	2.00000	38.3	2.21	2.09	374
10	2N009	24.0000	38	74.333	27.0000	101.667	117.000	23.2667	51.333	14.0000	3.00000	46.5	2.77	1.92	326
11	2N010	24.0000	34	78.333	25.3333	108.333	117.000	31.0000	68.667	11.6667	3.00000	45.2	3.01	2.24	410
12	2N011	22.0000	25	45.667	20.3333	83.333	117.000	32.1333	53.000	12.3333	2.33333	60.8	2.66	1.55	715
13	2N012	32.0000	36	33.667	14.0000	58.333	113.000	4.4000	8.667	10.0000	4.00000	44	2.12	1.28	251
14	2N013	22.0000	34	99.333	28.0000	92.667	112.000	24.6000	46.000	11.3333	2.33333	50.2	3.36	2.46	276
15	2N014	29.0000	37	65.000	33.6667	75.667	110.000	12.0333	33.333	21.0000	4.66667	36.7	2.46	1.82	187
16	2N015	32.0000	36	35.667	13.0000	94.000	107.000	8.9667	32.333	6.3333	2.66667	29.6	2.64	2.05	262
17	2N016	32.0000	32	57.000	20.3333	97.667	106.000	11.6000	42.667	9.6667	3.66667	24.9	2.54	1.8	225
18	2N017	15.0000	43	136.333	51.0000	97.333	105.000	32.8333	78.333	22.3333	4.33333	40.4	3.01	2.43	233
19	2N018	18.0000	40	168.333	64.3333	108.333	104.000	53.4000	106.667	26.6667	5.00000	45.3	2.51	2.39	288
20	2N019	24.0000	34	89.333	30.6667	105.667	102.000	31.8333	58.667	17.0000	3.00000	55.4	3.2	1.95	355
21	2N020	24.0000	26	62.667	25.3333	91.667	117.000	19.5333	39.333	13.3333	2.33333	50.4	2.41	1.88	362
22	2N021	22.0000	36	70.333	24.3333	101.667	117.000	31.9667	63.333	11.6667	1.66667	47.5	2.88	2.14	428
23	2N022	32.0000	38	46.333	19.0000	89.667	113.000	10.5333	40.000	11.0000	3.00000	25.7	2.43	1.75	220
24	2N023	29.0000	35	38.667	15.3333	103.667	112.000	9.3000	39.000	6.3333	2.00000	23.9	2.53	2.59	251
25	2N024	29.0000	37	47.333	20.6667	95.000	110.000	12.1333	39.000	11.0000	3.00000	32.3	2.42	1.87	249
26	2N025	32.0000	34	42.667	19.3333	92.333	107.000	9.5000	34.333	9.3333	4.00000	28.3	2.28	2.04	225
27	2N026	32.0000	34	46.667	16.0000	99.000	106.000	15.7000	38.667	7.0000	2.00000	40.5	3.08	2.23	331
28	2N027	15.0000	49	59.667	25.3333	114.333	105.000	12.8667	36.667	9.3333	1.66667	38.8	2.5	2.7	218
29	2N028	18.0000	40	78.667	33.0000	104.667	104.000	14.1000	34.000	8.6667	1.33333	37.2	2.32	3.64	167
30	2N029	32.0000	31	42.333	13.6667	92.000	102.000	15.7000	39.333	6.6667	3.00000	40.9	3.19	1.99	420
31	2N030	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32	2N031	28.0000	38	29.667	12.0000	111.667	117.000	10.2333	62.000	8.0000	4.66667	16.4	2.44	1.55	366
33	2N032	29.0000	35	68.333	22.6667	100.000	113.000	18.1667	57.667	12.0000	2.66667	31.6	3.01	1.89	280
34	2N033	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35	2N034	22.0000	34	70.333	28.3333	85.000	110.000	19.9333	42.333	17.3333	5.33333	43.9	3.09	1.58	252
36	2N035	22.0000	34	58.333	21.6667	76.667	107.000	18.2667	25.667	8.6667	2.00000	71.9	2.65	2.37	327
37	2N036	28.0000	38	61.667	20.6667	101.667	106.000	13.1000	49.667	12.6667	3.66667	23.4	2.89	1.52	224
38	2N037	15.0000	41	124.667	45.6667	110.000	105.000	42.9000	76.667	20.3333	3.00000	53.3	2.52	2.26	375
39	2N038	18.0000	38	95.000	32.3333	78.667	104.000	19.2667	42.667	16.3333	3.66667	44.8	2.99	2.01	201
40	2N039	15.0000	47	42.000	19.0000	82.333	102.000	7.3000	22.333	10.0000	3.00000	33.3	2.36	2.02	181
41	2N040	15.0000	45	63.333	28.6667	76.667	117.000	15.3667	33.000	16.0000	3.66667	45	2.3	1.82	244
42	2N041	32.0000	34	43.333	15.6667	91.000	117.000	11.3333	32.000	12.3333	4.33333	35.7	2.78	1.26	274
43	2N042	32.0000	34	132.333	52.0000	74.000	113.000	30.0000	68.667	21.6667	5.66667	41.2	2.53	2.36	215
44	2N043	29.0000	33	58.000	21.0000	101.667	112.000	13.4333	34.667	11.0000	2.33333	39.3	2.77	1.93	231
45	2N044	32.0000	34	30.000	13.6667	81.667	110.000	9.1667	33.667	6.3333	2.00000	25.3	2.58	1.94	308
46	2N045	32.0000	32	46.333	16.6667	100.000	107.000	11.8000	39.667	9.6667	2.66667	27.3	2.51	1.68	236
47	2N046	32.0000	28	62.000	23.0000	78.000	106.000	23.4333	41.000	11.0000	2.66667	57	2.72	2.06	388
48	2N047	32.0000	19	48.000	16.3333	95.667	105.000	23.3333	44.667	12.6667	3.33333	51.2	2.9	1.33	475
49	2N048	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50	2N049	28.0000	32	64.333	25.3333	106.667	117.000	28.9667	64.333	13.6667	4.00000	44.9	2.52	1.88	487
51	2N050	31.0000	32	46.333	20.0000	100.000	117.000	28.6333	59.000	12.0000	3.66667	46.7	2.29	1.66	631
52	2N051	22.0000	34	54.000	27.0000	76.667	117.000	32.6000	53.333	16.6667	4.33333	56.7	1.93	1.57	545
53	2N052	22.0000	26	52.667	18.6667	90.667	113.000	19.2333	34.667	16.3333	3.00000	55.4	2.98	1.16	372
54	2N053	22.0000	34	62.333	22.3333	91.667	112.000	31.6000	69.667	12.6667	3.00000	43.9	2.86	1.94	491
55	2N054	32.0000	30	57.333	23.3333	94.000	110.000	16.8333	37.667	10.6667	3.66667	38.5	2.34	1.98	281
56	2N055	22.0000	36	61.000	23.6667	83.000	107.000	13.1667	22.000	10.0000	3.00000	52.5	2.46	2.45	182

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
57	2N056	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	2N057	30	32	20.667	11.0000	89.333	105	11.6000	28.333	6.3333	4.33333	41.7	1.99	1.76	596
59	2N058	17	39	84.333	31.0000	96.667	104	23.8333	59.667	14.6667	3.33333	40.8	2.8	2.26	282
60	2N059	15	43	100.000	35.6667	97.667	102	27.3333	56.333	15.6667	3.33333	47.3	2.67	2.23	293
61	2N060	32	31	32.000	14.3333	111.000	117	12.7667	36.000	11.6667	2.33333	35.9	2.19	1.24	401
62	2N061	22	36	54.000	18.3333	90.667	117	10.0333	27.333	11.6667	2.33333	35.4	2.96	1.76	183
63	2N062	29	31	98.333	31.0000	94.000	113	26.0333	60.667	14.6667	3.33333	42.1	3.18	2.14	260
64	2N063	22	36	46.333	19.6667	95.000	112	11.5667	31.000	11.3333	2.33333	36.9	2.32	1.73	248
65	2N064	22	36	52.000	23.0000	85.000	110	32.8333	55.333	16.0000	3.66667	59.2	2.26	1.45	653
66	2N065	22	36	87.667	25.3333	98.333	107	20.4000	56.667	11.0000	3.66667	33.3	3.44	2.28	221
67	2N066	26	32	61.000	28.3333	102.000	106	31.7000	60.333	17.0000	3.33333	47.7	2.16	1.73	459
68	2N067	28	34	39.667	23.0000	97.000	105	15.4000	46.667	13.0000	2.33333	30.1	1.76	1.81	389
69	2N068	17	26	74.000	25.0000	106.000	104	25.2000	48.333	12.3333	3.00000	47.5	2.94	2.04	314
70	2N069	24	38	52.000	13.3333	96.667	102	17.1667	30.333	6.6667	2.66667	54	3.71	2.07	331
71	2N070	24	40	82.667	23.0000	100.667	117	23.1667	51.000	12.0000	3.33333	45.1	3.48	1.98	279
72	2N071	22	38	101.667	26.0000	98.333	117	31.0667	58.667	11.0000	2.66667	53.7	3.84	2.31	322
73	2N072	22	38	59.333	22.3333	98.333	113	25.3667	61.000	8.6667	2.00000	38.6	2.56	2.54	430
74	2N073	22	36	63.333	26.3333	91.000	112	19.5000	53.000	14.0000	2.66667	36.6	2.45	1.86	324
75	2N074	32	26	52.000	15.3333	98.333	110	25.7333	55.333	11.6667	3.00000	46.3	3.34	1.37	496
76	2N075	32	32	10.333	5.6667	81.667	107	9.5000	23.667	3.6667	4.66667	38.8	2.39	1.47	1109
77	2N076	22	34	127.333	40.0000	105.333	106	40.4333	82.000	20.6687	3.33333	50.4	3.15	1.75	341
78	2N077	.	.	.	.	.	.	.	.	.	.	.	.	.	.
79	2N078	17	43	158.333	49.3333	109.000	104	52.2000	97.333	21.3333	5.33333	53.7	3.24	2.28	323
80	2N079	.	.	.	.	.	.	.	.	.	.	.	.	.	.
81	2N080	24	19	28.333	12.0000	88.667	100	27.1333	42.667	11.0000	3.00000	63.1	2.77	1.11	873
82	2N081	32	26	111.333	17.3333	77.333	117	41.6667	70.333	14.3333	3.66667	58.2	5.61	1.2	537
83	2N082	32	29	44.000	17.0000	86.667	113	34.7667	65.000	15.0000	3.66667	55.3	2.54	1.19	757
84	2N083	32	30	62.000	24.5000	78.500	112	11.5000	32.000	15.5000	3.50000	30.9	2.45	1.57	160
85	2N084	32	32	49.000	19.0000	95.667	110	15.0000	56.333	12.3333	4.33333	24	2.38	1.47	328
86	2N085	32	32	21.333	12.6667	82.667	107	13.8000	29.000	12.0000	3.33333	48.6	1.66	1.06	648
87	2N086	32	36	34.667	15.0000	98.000	106	8.3667	30.667	7.3333	2.66667	25.9	2.34	2.06	217
88	2N087	32	30	48.000	15.6667	98.333	105	19.7667	41.000	12.6667	2.66667	49.2	3.12	1.22	427
89	2N088	32	28	66.333	21.3333	98.667	104	22.1333	49.667	14.6667	3.33333	45.1	3.12	1.45	333
90	2N089	32	27	25.667	11.3333	101.667	117	21.1667	48.333	11.0000	2.33333	44.4	2.35	1.03	834
91	2N090	.	.	.	.	.	.	.	.	.	.	.	.	.	.
92	2N091	22	26	28.333	12.0000	73.667	117	37.8333	48.000	12.0000	4.00000	229	2.84	1.29	1279
93	2N092	32	32	42.667	15.3333	80.000	113	24.0333	59.000	12.6667	2.33333	38.7	2.65	1.26	558
94	2N093	.	.	.	.	.	.	.	.	.	.	.	.	.	.
95	2N094	32	34	33.667	13.0000	102.667	110	5.2000	27.667	6.0000	2.00000	18.1	2.59	2.07	156
96	2N095	32	34	44.333	15.6667	95.000	107	10.6000	33.000	9.0000	3.33333	29.9	2.63	2	259
97	2N096	32	34	65.333	29.3333	95.333	106	16.1667	51.000	14.6667	4.00000	30.7	2.42	2.08	247
98	2N097	32	30	51.000	16.3333	106.333	105	17.7333	41.333	12.3333	2.33333	42.6	3.09	1.56	353
99	2N098	17	31	115.333	32.3333	111.667	104	60.2667	109.667	21.0000	4.00000	54.2	3.45	1.49	568
100	2N099	15	34	70.333	27.3333	99.667	102	34.0000	68.000	19.3333	3.00000	48.1	2.58	1.5	478
101	2N100	15	33	81.667	28.3333	109.000	100	44.8333	87.000	16.0000	2.66667	47.2	3.04	1.78	523
102	2N101	32	32	27.667	9.3333	80.000	117	19.9333	39.667	5.6667	1.66667	50.8	3.02	1.63	741
103	2N102	32	32	23.667	10.3333	95.000	113	6.7667	34.333	6.6667	2.66667	22.5	2.09	1.57	420
104	2N103	.	.	.	.	.	.	.	.	.	.	.	.	.	.
105	2N104	32	26	25.000	10.6667	101.667	110	9.3667	28.000	6.6667	1.66667	35.2	2.52	1.64	380
106	2N105	32	32	34.333	15.0000	95.000	107	16.7333	42.667	10.3333	1.66667	39.2	2.31	1.51	479
107	2N106	35	31	14.000	4.0000	80.000	106	3.4000	40.000	2.0000	3.00000	8.50	3.5	2	243
108	2N107	32	30	46.667	15.0000	100.333	105	13.7667	36.667	9.3333	3.00000	37.8	3.18	1.74	286
109	2N108	.	.	.	.	.	.	.	.	.	.	.	.	.	.
110	2N109	28	30	75.333	22.3333	111.000	102	19.9000	66.667	11.0000	2.66667	27.2	3.41	.2	241
111	2N110	32	24	40.000	14.0000	106.667	117	15.4000	34.667	8.3333	2.00000	43.7	2.82	1.69	386
112	2N111	28	30	38.000	13.0000	80.000	117	22.2333	40.333	9.6667	2.33333	57	2.92	1.37	606

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
113	2N112	32	26	76.667	27.0000	86.333	113	28.9667	55.000	15.6667	3.6667	52.6	2.81	1.78	386
114	2N113	32	30	60.333	17.6667	86.667	112	31.2333	56.333	13.3333	3.0000	55.4	3.41	1.33	521
115	2N114	32	28	35.000	15.6667	78.333	110	17.9000	37.333	11.3333	3.0000	43.7	2.08	1.36	503
116	2N115	.	.	.	.	.	.	.	.	.	.	.	.	.	.
117	2N116	22	36	111.333	37.3333	80.667	106	21.8333	42.667	23.0000	3.0000	45.1	2.67	1.59	203
118	2N117	28	30	48.667	18.0000	93.333	105	18.7333	41.000	12.0000	2.3333	46.9	2.67	1.49	402
119	2N118	18	40	74.000	23.3333	101.667	104	17.1000	37.333	11.0000	2.3333	43.6	3.18	2.27	222
120	2N119	28	32	74.000	22.3333	110.667	102	33.2000	72.000	14.3333	2.6667	46.1	3.25	1.58	456
121	2N120	17	29	77.667	24.0000	108.667	100	44.0333	85.333	20.6667	4.0000	52.3	3.23	1.16	561
122	2N121	32	34	22.000	15.3333	101.667	117	9.0000	39.000	10.0000	3.0000	28	1.55	1.75	416
123	2N122	32	30	23.000	8.3333	82.333	113	12.0333	35.333	7.6667	3.0000	31.6	2.64	1.07	518
124	2N123	32	32	41.333	19.0000	73.333	112	24.8000	53.667	11.6667	4.0000	44.3	2.12	1.61	594
125	2N124	32	32	.	.	91.667	110	.	.	13.3333	3.6667	.	.	.	.
126	2N125	32	34	21.000	11.0000	73.333	107	2.1667	8.667	7.3333	3.3333	25.7	2	1.51	101
127	2N126	35	29	6.000	3.0000	70.000	106	5.5000	21.000	2.0000	5.0000	26.2	2	1.5	917
128	2N127	32	32	41.667	18.6667	84.333	105	21.4000	48.667	13.0000	6.0000	44.5	2.41	1.45	504
129	2N128	32	32	4.667	5.0000	82.333	104	2.6000	47.667	5.0000	17.5000	7.06	.815	1	562
130	2N129	32	32	3.000	6.5000	91.000	102	1.8500	28.500	3.5000	3.5000	6.74	.472	1.79	650
131	2N130	34	24	43.000	15.5000	70.000	117	15.7500	24.500	10.0000	2.5000	65.4	3.05	1.49	351
132	2N131	22	38	68.667	22.6667	92.333	117	24.4667	42.000	9.0000	1.6667	56.8	3.07	2.68	351
133	2N132	.	.	.	.	.	.	.	.	.	.	.	.	.	.
134	2N133	32	30	71.333	25.0000	84.000	112	30.3667	53.333	14.6667	3.6667	56.9	2.89	1.71	424
135	2N134	32	32	91.667	33.6667	93.667	110	37.5000	78.333	17.0000	4.0000	47.1	2.63	2	421
136	2N135	32	32	46.667	17.6667	100.000	107	17.6000	46.000	11.6667	3.6667	41	2.81	1.52	392
137	2N136	32	32	49.333	17.6667	87.667	106	15.5333	31.667	9.3333	2.3333	45.3	2.88	1.81	307
138	2N137	24	36	54.333	21.0000	104.333	105	21.1000	49.000	14.6667	3.0000	43.3	2.55	1.43	387
139	2N138	18	42	86.333	29.6667	109.333	104	18.6667	57.667	14.6667	3.0000	32.5	2.91	1.9	230
140	2N139	24	26	105.333	36.3333	119.000	102	50.9333	110.333	18.0000	3.6667	45.8	2.94	2.09	492
141	2N140	18	38	68.000	25.0000	102.333	117	31.7333	63.333	16.6667	3.3333	49.4	2.69	1.48	474
142	2N141	32	34	65.000	27.3333	75.000	117	25.5000	51.000	13.6667	5.0000	49.1	2.22	2.15	424
143	2N142	32	33	7.667	4.3333	61.667	113	2.1667	19.000	4.0000	10.0000	12.7	1.93	1.08	273
144	2N143	32	32	34.667	13.3333	81.667	112	19.6333	35.000	8.3333	4.6667	51.2	2.5	1.55	647
145	2N144	32	32	38.000	19.3333	88.333	110	10.7000	39.333	10.3333	6.0000	27.9	1.9	1.65	385
146	2N145	32	32	25.333	10.6667	105.000	107	14.4333	40.667	6.6667	6.0000	31.6	2.16	1.47	707
147	2N146	32	30	27.333	12.0000	95.000	106	13.2000	29.000	7.0000	3.3333	39.3	2.11	1.59	446
148	2N147	.	.	.	.	.	.	.	.	.	.	.	.	.	.
149	2N148	32	30	43.667	18.0000	102.667	104	17.6667	46.667	15.0000	2.6667	37.9	2.43	1.21	404
150	2N149	32	23	29.000	11.6667	93.000	102	20.7667	51.333	9.0000	2.6667	40.6	2.38	1.31	809
151	2N150	.	.	.	.	.	.	.	.	.	.	.	.	.	.
152	2N151	32	28	41.667	16.6667	65.000	117	40.4333	64.333	13.6667	5.0000	62.8	2.6	1.26	909
153	2N152	.	.	.	.	.	.	.	.	.	.	.	.	.	.
154	2N153	32	29	23.667	9.3333	57.333	112	20.4000	37.333	5.6667	3.6667	54.5	2.46	1.65	899
155	2N154	.	.	.	.	.	.	.	.	.	.	.	.	.	.
156	2N155	32	30	48.667	21.3333	97.667	107	10.9333	37.667	12.6667	2.3333	28.7	2.38	1.7	223
157	2N156	32	32	51.000	22.3333	93.000	106	15.1667	52.333	14.3333	5.3333	27.8	2.29	1.68	307
158	2N157	32	30	16.333	9.3333	92.667	105	12.8333	35.333	6.6667	2.6667	35.4	1.64	1.38	750
159	2N158	28	30	71.000	25.0000	93.333	104	20.4000	36.667	13.0000	3.3333	56.2	3.07	1.9	292
160	2N159	32	32	33.000	15.3333	99.333	102	21.7333	51.000	7.6667	3.0000	42.7	2.18	2.04	670
161	2N160	.	.	.	.	.	.	.	.	.	.	.	.	.	.
162	2N161	.	.	.	.	.	.	.	.	.	.	.	.	.	.
163	2N162	32	30	37.667	16.6667	79.000	113	23.6667	53.333	9.0000	4.3333	43.7	2.33	1.85	631
164	2N163	.	.	.	.	.	.	.	.	.	.	.	.	.	.
165	2N164	32	32	37.000	14.6667	86.667	110	9.4000	31.667	10.6667	3.6667	28.5	2.52	1.35	257
166	2N165	32	32	50.000	16.3333	94.333	107	21.4667	44.000	9.3333	3.6667	47.2	2.98	1.73	411
167	2N166	32	32	42.000	10.6667	96.000	106	30.3667	56.333	7.3333	3.0000	54.3	4	1.51	760
168	2N167	32	34	1.667	2.0000	88.667	105	1.8000	45.667	2.0000	20.3333	3.52	.667	1	1087

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
169	2N168	32	34	48.000	17.6667	93.333	104.000	16.1667	43.333	10.0000	6.00000	36.1	2.51	1.63	435
170	2N169	32	29	60.667	26.3333	91.667	102.000	14.6667	40.667	12.0000	4.00000	37.9	2.24	2.2	262
171	2N170	32	29	24.000	13.3333	80.000	117.000	11.0667	42.000	8.6667	3.66667	33.3	1.78	1.56	477
172	2N171	.	.	.	.	.	.	.	.	.	.	.	.	.	.
173	2N172	29	29	33.000	13.6667	84.000	113.000	18.8000	30.000	5.6667	2.33333	59.4	2.33	2.43	552
174	2N173	32	32	51.000	17.6667	88.333	112.000	20.5667	48.000	10.0000	7.00000	41.1	2.81	1.74	409
175	2N174	32	24	39.667	19.0000	68.333	110.000	11.8333	25.333	9.3333	3.66667	42.9	2.04	2.26	268
176	2N175	32	30	53.333	20.6667	85.667	107.000	28.7667	53.667	9.6667	6.66667	53.7	2.67	2.11	594
177	2N176	.	.	.	.	.	.	.	.	.	.	.	.	.	.
178	2N177	.	.	.	.	.	.	.	.	.	.	.	.	.	.
179	2N178	28	28	128.000	46.3333	105.000	104.000	70.8333	142.000	27.3333	5.00000	41.1	2.47	1.68	457
180	2N179	28	28	30.667	9.0000	106.333	102.000	22.3333	57.333	8.3333	3.00000	39.8	3.46	1.04	961
181	2N180	24	24	31.333	16.0000	85.667	100.000	14.5000	25.000	8.6667	3.00000	56.1	1.91	1.91	527
182	2N181	22	26	83.333	33.0000	84.000	117.000	70.0333	123.333	18.6667	4.66667	58.7	2.5	1.73	829
183	2N182	22	26	42.667	12.3333	107.333	113.000	45.9667	89.667	11.0000	3.33333	51.7	3.61	1.1	1113
184	2N183	22	40	9.333	2.3333	82.000	112.000	6.5333	51.333	2.3333	5.66667	12.4	3.56	1	824
185	2N184	22	36	46.667	13.6667	92.667	110.000	28.7000	65.667	12.3333	4.33333	38	3.02	1.08	611
186	2N185	.	.	.	.	.	.	.	.	.	.	.	.	.	.
187	2N186	32	26	24.667	9.0000	84.333	106.000	18.3333	47.667	7.6667	3.00000	38.8	2.7	1.23	788
188	2N187	24	34	37.333	12.6667	103.333	105.000	14.4333	55.000	5.6667	5.00000	24.8	2.18	1.8	452
189	2N188	28	32	3.000	3.6667	92.667	104.000	2.3333	42.333	3.6667	4.66667	6.87	1.22	1	810
190	2N189	15	35	34.333	10.3333	107.000	102.000	23.5667	81.333	10.3333	4.66667	28.2	3.35	1	694
191	2N190	18	25	54.000	15.0000	96.667	100.000	44.2000	78.333	12.0000	3.00000	54.6	3.45	1.22	866
192	2N191	32	32	4.333	4.0000	65.000	117.000	1.9000	20.667	4.0000	8.66667	8.86	1.07	1	372
193	2N192	.	.	.	.	.	.	.	.	.	.	.	.	.	.
194	2N193	.	.	.	.	.	.	.	.	.	.	.	.	.	.
195	2N194	29	29	75.000	27.0000	54.333	110.000	8.5667	17.333	25.3333	9.00000	37.8	2.74	1.06	88
196	2N195	22	38	36.333	12.6667	101.667	107.000	16.6333	30.667	6.6667	1.66667	56	2.96	1.82	563
197	2N196	22	38	52.667	30.6667	91.000	106.000	21.3333	46.667	15.0000	4.00000	42.5	2.2	1.82	380
198	2N197	24	32	56.000	16.3333	108.000	105.000	15.7000	39.000	10.6667	2.33333	40.6	3.45	1.54	279
199	2N198	18	40	96.000	32.0000	109.333	104.000	19.5000	45.333	12.3333	3.00000	42.3	3	2.74	201
200	2N199	15	35	54.667	16.0000	103.667	102.000	27.2333	61.000	9.3333	2.33333	45.2	3.49	1.71	512
202	2N200	18	34	78.667	27.0000	113.333	100.000	40.3000	93.667	17.6667	2.66667	42.3	2.97	1.54	508
203	2N201	28	28	40.333	16.3333	45.000	117.000	10.7667	21.000	8.3333	1.66667	50.1	2.51	1.93	261
204	2N202	22	34	54.667	21.0000	98.333	113.000	21.8333	44.667	10.6667	2.66667	42.9	2.63	1.83	351
205	2N203	22	34	93.667	34.6667	105.000	112.000	26.4667	56.333	16.6667	2.33333	46.8	2.73	2.07	278
206	2N204	22	26	45.667	24.6667	72.333	110.000	44.1667	72.333	16.0000	8.00000	58	1.8	1.61	1060
207	2N205	22	38	37.000	19.6667	85.667	107.000	23.0333	47.000	12.3333	4.33333	49	1.95	1.58	650
208	2N206	28	30	38.333	12.6667	71.667	106.000	17.2333	33.000	8.0000	4.66667	51.8	2.99	1.59	459
209	2N207	18	31	38.000	18.5000	97.500	105.000	33.8000	50.000	12.0000	4.50000	66.2	1.88	1.52	941
210	2N208	28	28	89.333	29.0000	88.000	104.000	53.3667	91.667	15.6667	6.66667	58.3	3.27	1.85	611
211	2N209	.	.	.	.	.	.	.	.	.	.	.	.	.	.
212	2N210	.	.	.	.	.	.	.	.	.	.	.	.	.	.
213	2N211	22	26	62.333	25.3333	86.667	117.000	41.9000	85.667	17.6667	4.33333	49.5	2.48	1.47	678
214	2N212	22	36	24.667	9.6667	81.667	112.667	23.4000	40.000	5.6667	2.33333	52.5	2.33	1.68	946
215	2N213	28	30	37.000	11.6667	75.000	112.000	29.1333	46.667	7.0000	1.66667	60.6	3.17	1.69	882
216	2N214	22	28	112.333	46.0000	78.333	110.000	39.3333	74.667	21.6667	6.00000	51.8	2.47	2.07	402
217	2N215	22	36	48.333	25.0000	73.333	107.000	19.7333	47.000	14.3333	7.66667	42.5	1.96	1.73	458
218	2N216	22	36	45.333	14.0000	86.667	106.000	36.4000	74.333	11.3333	7.66667	36.8	2.74	1.1	863
219	2N217	18	42	105.667	36.0000	116.667	105.000	27.4000	71.667	10.6667	2.33333	34.6	2.7	3.22	234
220	2N218	18	36	92.333	31.0000	129.000	104.000	29.5667	62.000	14.0000	1.33333	48.3	3.02	2.37	322
221	2N219	17	32	83.333	24.3333	111.667	103.000	33.7333	69.667	14.6667	3.00000	48.6	3.55	1.58	501
222	2N220	15	39	69.000	29.3333	105.667	100.000	21.5667	63.333	16.3333	2.66667	31.7	2.34	2.32	304
223	2N221	22	38	75.000	25.0000	106.667	117.000	27.6000	66.667	12.0000	2.33333	41	3.06	2.2	366
224	2N222	22	36	58.333	20.6667	95.000	113.000	15.6667	38.333	12.6667	3.33333	40.2	2.84	1.67	267

STATISTICAL ANALYS

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
225	2N223	22	36	77.667	31.0000	115.667	112	37.1000	74.667	16.0000	2.0000	48.5	2.54	1.89	477
226	2N224	29	33	60.000	24.0000	99.333	110	18.5333	39.667	11.6667	2.6667	47.5	2.37	2.23	304
227	2N225	.	.	.	.	.	.	.	.	.	.	.	.	.	.
228	2N226	.	.	.	.	.	.	.	.	.	.	.	.	.	.
229	2N227	24	34	120.000	49.6667	115.667	105	28.5667	63.667	20.6667	3.3333	44.9	2.4	2.58	240
230	2N228	.	.	.	.	.	.	.	.	.	.	.	.	.	.
231	2N229	18	36	102.667	32.0000	131.000	103	31.4667	68.333	12.3333	2.0000	46.3	3.23	2.59	310
232	2N230	24	28	26.000	10.3333	86.000	100	19.9000	48.333	9.0000	6.0000	41.6	2.59	1.12	762
233	2N231	28	32	46.667	17.0000	69.000	117	27.4333	80.667	11.6667	6.0000	34.2	2.68	1.43	628
234	2N232	22	36	16.667	14.3333	85.000	113	21.5000	66.667	13.0000	6.6667	33.5	1.44	1.09	1416
235	2N233	22	24	29.667	16.0000	78.667	112	8.6000	20.333	9.0000	4.3333	38.8	1.63	1.67	327
236	2N234	29	31	45.667	18.0000	74.000	110	18.3333	35.000	11.6667	3.0000	46	3.01	1.47	428
237	2N235	22	36	57.333	22.3333	75.000	107	32.4333	50.667	15.0000	8.0000	63.9	2.53	1.47	589
238	2N236	22	36	81.000	38.3333	89.333	106	44.4667	96.667	21.6667	7.3333	44.7	2.22	1.71	584
239	2N237	18	32	68.333	17.0000	106.667	105	59.3000	116.667	12.6667	4.3333	49.5	4.03	1.27	924
240	2N238	24	34	19.667	7.3333	73.000	104	17.3667	54.000	6.6667	8.6667	33.5	2.75	1.11	870
241	2N239	18	25	65.000	19.0000	95.000	103	16.2000	50.667	14.6667	3.0000	35.9	3.02	1.25	316
242	2N240	17	23	55.667	28.6667	60.667	100	25.4333	31.333	16.3333	5.0000	81.1	1.95	1.73	483
243	2N241	.	.	.	.	.	.	.	.	.	.	.	.	.	.
244	2N242	24	24	46.000	20.0000	62.333	113	10.3333	22.000	11.6667	5.0000	51.4	2.29	1.71	237
245	2N243	22	26	79.667	29.6667	88.333	112	23.1333	42.333	12.6667	3.3333	52.5	3.96	2.3	402
246	2N244	29	37	14.000	9.6667	60.000	110	3.7000	14.333	5.6667	2.3333	25.6	1.52	1.67	243
247	2N245	28	28	34.333	21.6667	57.667	107	10.6333	21.333	13.0000	4.0000	45.2	1.55	1.79	316
248	2N246	22	27	16.333	10.0000	70.000	106	10.8333	20.000	7.3333	4.3333	51.6	1.6	1.36	627
249	2N247	18	24	75.333	34.3333	76.667	105	41.5000	63.000	23.0000	6.6667	65.2	2.22	1.44	548
250	2N248	24	32	42.333	18.6667	89.000	104	24.2667	55.000	14.3333	7.6667	47.3	2.26	1.32	550
251	2N248	18	25	63.867	28.0000	97.333	103	39.6333	78.667	16.6667	3.6667	50.3	2.32	1.81	631
252	2N250	15	33	71.000	22.3333	104.000	100	33.2667	60.667	12.0000	2.3333	55	3.24	1.91	463
253	2N251	22	23	37.667	17.3333	76.667	117	31.3000	46.333	10.3333	4.6667	68.3	2.16	1.67	828
254	2N252	22	26	51.000	17.6667	85.000	113	19.1333	38.000	10.6667	2.0000	56.5	2.95	1.65	429
255	2N253	22	26	15.667	10.6667	66.667	112	14.2000	49.333	10.6667	11.0000	27.5	1.4	1.14	774
256	2N254	29	19	30.667	17.0000	61.667	110	22.9000	34.333	12.6667	4.6667	66.2	1.81	1.34	742
257	2N255	22	26	55.333	17.0000	103.333	107	33.4667	60.333	11.0000	3.3333	56.8	3.63	1.47	702
258	2N256	18	30	26.000	12.6667	86.667	106	21.7333	45.667	9.6667	4.6667	47.2	2	1.25	1007
259	2N257	18	32	70.333	33.6667	79.667	105	29.8333	55.667	19.6667	6.0000	53.8	2.13	1.74	428
260	2N258	24	19	36.000	13.0000	75.000	104	42.2333	69.000	9.6667	4.6667	62.4	2.83	1.43	1181
261	2N259	20	22	37.333	16.3333	85.333	103	37.1667	82.333	13.6667	11.0000	42.4	2.18	1.19	965
262	2N260	24	19	77.333	33.3333	89.333	100	61.3667	98.000	20.3333	6.3333	62.3	2.31	1.64	828
263	2N261	22	34	29.667	15.6667	72.333	117	32.8000	67.667	10.6667	4.0000	47.5	1.97	1.45	1176
264	2N262	22	36	35.333	16.6667	100.667	113	19.1000	41.333	8.3333	1.6667	47.6	2.13	2.17	532
265	2N263	29	29	32.667	14.6667	81.000	112	24.8667	44.667	13.0000	3.3333	54.7	2.25	1.13	760
266	2N264	29	27	34.000	15.6667	67.333	110	18.0000	34.333	9.0000	2.6667	51.7	2.33	1.7	518
267	2N265	22	26	11.333	7.6667	78.333	107	8.3667	17.000	6.3333	2.6667	47.6	1.46	1.21	711
268	2N266	22	26	40.333	21.0000	82.333	106	21.2667	38.000	11.0000	3.0000	53.6	1.9	1.83	484
269	2N267	18	30	96.667	34.0000	88.333	105	63.6333	100.333	22.3333	6.0000	62.5	2.76	1.6	703
270	2N268	24	24	34.667	12.6667	75.000	105	27.2333	51.000	9.6667	7.6667	57.6	2.79	1.3	785
271	2N269	18	24	28.333	12.6667	75.667	103	21.6667	36.333	9.0000	5.3333	54.4	1.94	1.3	848
272	2N270	32	28	45.000	18.3333	75.667	100	27.5000	55.000	12.3333	4.0000	49.3	2.42	1.43	671
273	2N271	26	23	34.333	15.3333	81.667	117	24.4667	33.333	8.0000	1.6667	74.1	2.21	2.05	734
274	2N272	22	26	27.333	13.6667	80.000	113	21.7667	38.333	9.0000	2.6667	59.1	2.15	1.45	852
275	2N273	22	30	43.667	25.0000	76.667	112	28.1333	65.333	15.6667	4.3333	38.6	1.58	1.58	705
276	2N274	22	36	23.333	15.6667	74.000	110	14.6333	48.667	12.0000	5.3333	29.6	1.48	1.31	628
277	2N275	22	26	17.667	9.0000	76.667	107	15.8000	22.333	5.6667	3.6667	69.3	1.94	1.54	1040
278	2N276	22	34	28.667	13.0000	100.667	106	16.0667	44.333	9.3333	2.6667	30.3	1.98	1.37	474
279	2N277	18	38	65.667	21.6667	89.000	105	36.6000	68.000	16.6667	5.0000	56.6	2.95	1.33	579
280	2N278	24	21	77.333	29.6667	92.667	105	40.5333	81.000	18.6667	6.3333	48.5	2.7	1.56	652

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
281	2N279	18	30	18.3333	9.6667	83.333	103	19.8333	32.3333	7.3333	4.0000	57.1	1.8	1.34	1165
282	2N280	15	30	77.3333	24.6667	86.667	100	42.6000	72.3333	19.3333	7.3333	57.7	2.83	1.34	561
283	2N281	.	.	.	.	.	.	.	.	.	.	.	.	.	.
284	2N282	29	35	36.3333	13.6667	78.333	113	15.1667	24.6667	6.0000	2.3333	55.8	2.65	2.28	404
285	2N283	28	28	41.0000	17.6667	71.667	112	9.2333	25.0000	10.3333	5.6667	35.5	2.41	1.46	245
286	2N284	25	23	24.6667	8.3333	85.000	110	26.0667	45.3333	8.0000	3.0000	53.5	2.99	1.06	974
287	2N285	22	32	36.3333	11.0000	105.000	107	20.0000	53.0000	8.6667	2.6667	38.9	3.27	1.33	538
288	2N286	28	28	28.3333	9.0000	80.667	106	23.4333	46.0000	8.0000	3.6667	52.4	3.04	1.1	913
289	2N287	24	34	7.0000	9.0000	97.667	105	6.7667	37.3333	6.3333	6.0000	18.6	.796	1.46	986
290	2N288	24	30	9.0000	3.6667	97.333	105	5.7667	23.6667	3.3333	2.3333	26.4	2.42	1.11	694
291	2N289	18	31	64.6667	22.3333	100.667	103	30.5667	54.3333	12.0000	3.0000	55.6	2.98	2.16	460
292	2N290	24	33	39.3333	25.3333	85.667	100	10.0333	53.0000	19.3333	6.6667	14.9	1.16	1.26	277
293	2N291	28	30	20.6667	10.0000	60.000	117	5.5000	26.6667	7.3333	13.0000	15.8	1.89	1.35	260
294	2N292	29	29	44.0000	15.3333	68.333	113	22.4333	32.6667	10.6667	3.0000	68.6	2.95	1.48	519
295	2N293	29	29	27.6667	8.3333	79.000	112	27.9000	59.0000	6.6667	4.0000	35.8	2.5	1.12	1207
296	2N294	29	19	.	13.0000	83.333	110	.	.	11.0000	4.0000	.	.	1.12	.
297	2N295	22	28	69.3333	23.6667	106.667	107	26.6333	47.6667	12.3333	2.3333	56.1	2.83	2.03	436
298	2N296	22	36	72.3333	25.0000	103.333	106	28.9333	52.6667	9.0000	2.3333	53.4	2.86	2.89	391
299	2N297	24	26	95.6667	37.0000	75.333	105	26.5000	48.3333	24.3333	5.6667	53.8	2.54	1.57	307
300	2N298	17	29	40.0000	14.6667	101.333	105	22.2333	47.6667	11.0000	3.3333	42.5	3.07	1.27	546
301	2N299	20	36	34.3333	16.6667	85.667	103	16.0667	48.3333	13.3333	6.0000	32.1	2.02	1.26	478
302	2N300	24	24	39.6667	20.3333	78.000	100	41.4000	79.3333	16.0000	6.6667	51	1.86	1.37	1084
303	2N301	22	26	42.3333	14.0000	80.000	118	39.5333	67.0000	11.3333	3.3333	58.8	3.03	1.25	950
304	2N302	22	21	33.0000	15.0000	68.333	117	26.6000	44.3333	13.3333	5.6667	58.8	2.18	1.14	778
305	2N303	22	26	15.0000	7.0000	70.667	113	9.3333	23.6667	5.6667	4.0000	39.2	2.18	1.22	601
306	2N304	29	31	23.0000	13.0000	76.333	112	5.7000	20.3333	8.6667	5.0000	28.4	1.72	1.48	293
307	2N305	22	34	39.0000	16.6667	85.000	110	23.3000	41.6667	12.6667	5.3333	55.6	2.17	1.36	574
308	2N306	28	30	23.3333	9.6667	78.333	107	16.1000	43.0000	7.6667	4.0000	34.7	2.26	1.46	722
309	2N307	24	23	83.3333	26.3333	90.333	106	50.9333	88.3333	21.0000	5.3333	56.8	2.95	1.33	667
310	2N308	18	26	50.3333	11.0000	90.000	105	24.2000	44.6667	7.6667	4.3333	57.3	4.75	1.51	534
311	2N309	18	28	18.0000	8.0000	96.667	103	14.6333	34.6667	6.6667	3.6667	42	2.3	1.2	859
312	2N310	.	.	.	.	.	.	.	.	.	.	.	.	.	.
313	2N311	32	22	19.0000	13.6667	66.667	118	16.4000	32.3333	8.3333	5.3333	50.4	1.44	1.63	777
314	2N312	22	26	78.3333	25.6667	87.667	117	47.7333	75.3333	17.6667	3.6667	63.5	3.15	1.56	581
315	2N313	22	26	32.0000	15.0000	76.000	113	19.1333	32.0000	11.6667	4.0000	60.4	2.11	1.3	612
316	2N314	22	26	48.6667	18.0000	85.000	112	21.3667	34.6667	9.6667	2.3333	56.1	2.44	1.71	434
317	2N315	22	36	25.0000	11.0000	78.333	110	19.2667	40.3333	7.3333	6.0000	44.4	2.33	1.42	773
318	2N316	22	23	84.3333	36.0000	87.667	107	36.3333	78.0000	15.6667	5.0000	45.5	2.53	2.29	453
319	2N317	18	30	74.0000	21.6667	104.333	106	25.1667	46.6667	15.0000	3.3333	54.2	3.45	1.44	346
320	2N318	18	30	5.3333	3.0000	99.667	105	5.3000	41.6667	2.6667	3.6667	12.5	1.94	1.33	972
321	2N319	20	38	92.6667	34.6667	104.000	103	21.5333	55.6667	15.3333	4.0000	36.5	2.71	2.22	219
322	2N320	17	31	24.3333	12.3333	83.333	100	12.5667	52.6667	10.0000	5.3333	20.7	1.99	1.22	646
323	2N321	26	32	24.3333	6.0000	78.333	118	22.2667	37.0000	5.3333	2.3333	59.5	4	1.11	943
324	2N322	22	38	77.3333	33.3333	97.333	117	18.4333	50.0000	13.6667	4.3333	37.7	2.27	2.5	252
325	2N323	.	.	.	.	.	.	.	.	.	.	.	.	.	.
326	2N324	25	23	38.6667	16.6667	79.333	112	17.3333	31.3333	10.6667	4.3333	53.2	2.45	1.74	419
327	2N325	.	.	.	.	.	.	.	.	.	.	.	.	.	.
328	2N326	22	36	21.0000	7.3333	76.000	107	.	.	5.6667	3.6667	.	3.04	1.3	.
329	2N327	24	26	21.6667	9.3333	86.000	106	18.6667	41.0000	8.3333	6.3333	45.9	2.52	1.11	864
330	2N328	24	26	3.0000	3.3333	83.333	105	2.5000	28.6667	2.6667	4.6667	9.74	1.02	1.22	810
331	2N329	20	29	6.6667	3.0000	90.667	103	4.8667	33.6667	3.0000	7.6667	15.2	2.39	1	747
332	2N330	24	22	53.3333	20.0000	83.333	100	38.9333	70.0000	18.0000	5.3333	55.2	2.55	1.1	764
333	2N331	22	27	22.6667	7.3333	80.000	118	28.2000	46.3333	7.3333	3.3333	55.1	2.99	1	1102
334	2N332	22	34	38.6667	16.0000	91.333	117	13.5667	31.0000	7.0000	2.3333	43.9	2.8	2.27	349
335	2N333	22	34	26.6667	9.6667	92.667	113	19.6667	50.6667	5.6667	5.6667	43.1	2.74	1.79	780
336	2N334	29	29	48.0000	19.6667	77.333	112	29.8000	53.3333	14.6667	5.3333	55.9	2.53	1.35	605

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OBS ACCNBR           EMERG   FLOWER SEEDS    PODS     HEIGHT  MATURITY YIELD   TDM     NODES   STALKS   HI   SEEDSPOD PPNODE MKWT

337 2N335           22.0000    26   44.0000 19.3333   78.333 110.000  36.6667 57.3333 13.3333 4.00000 64.4    2.33     1.46   832
338 2N336           22.0000    25   59.3333 22.6667   81.333 107.000  35.0667 69.3333 12.6667 4.66667 48.4    2.66     1.82   579
339 2N337           18.0000    30   97.0000 29.3333  105.000 106.000  40.0000 74.0000 16.6667 3.66667 51.7    3.22     1.71   406
340 2N338           18.0000    30   36.0000 12.3333   85.333 105.000  26.9000 72.0000 10.6667 6.00000 37.1    3.19     1.09   886
341 2N339           20.0000    25   69.6667 27.3333  106.333 103.000  33.7000 62.3333 14.0000 3.00000 51.6    2.54     1.85   462
342 2N340           17.0000    30   65.3333 25.0000   96.667 100.000  40.9667 81.3333 20.6667 6.00000 49.9     2.5     1.23   665
343 2N341           28.0000    30   28.6667  8.3333   72.000 118.000  21.3333 31.3333  5.3333 2.33333 65.4    2.96     1.52   949
344 2N342           22.0000    28   73.6667 24.0000   74.000 117.000  30.8000 58.3333 13.6667 7.66667   54    2.99     1.77   488
345 2N343           24.0000    34   13.3333  8.0000   89.333 113.000  10.5667 30.3333  5.0000 3.66667 32.8    1.63     1.53   737
346 2N344           22.0000    36   46.0000 17.0000  109.000 112.000  26.4000 57.6667 10.6667 3.00000 46.5    2.69     1.62   615
347 2N345           32.0000    24   64.0000 23.0000   78.000 110.000  39.0667 64.6667 14.6667 5.00000 55.2    2.45     1.58   748
348 2N346           28.0000    30   27.3333 12.0000  104.333 107.000  12.0333 41.6667  9.3333 2.00000 29.3    2.29     1.32   442
349 2N347           24.0000    32   28.0000 11.3333   98.333 106.000  29.2333 58.0000  8.3333 4.33333 48.1    2.28     1.37  1176
350 2N348           32.0000    28   53.0000 15.0000   81.333 104.667  26.1333 67.6667  9.0000 4.00000 32.9    3.56     1.53   468
351 2N349           32.0000    28   12.0000  6.0000   84.333 103.000  17.4333 28.3333  5.0000 3.66667 61.9    1.68     1.14  3897
352 2N350           24.0000    24   14.3333  5.3333   84.333 100.000  15.4333 34.3333  4.0000 3.66667 44.1    2.72     1.39  1089
353 2N351           28.0000    28   15.3333  7.6667   70.000 118.000  19.2000 42.0000  6.0000 5.66667 41.7    1.86     1.26  1207
354 2N352           28.0000    32   20.3333  8.0000   81.667 117.000  15.4333 37.6667  4.6667 3.33333 42.8    2.39        2   777
355 2N353           29.0000    31   27.3333 15.0000   82.667 113.000  17.3000 46.6667 12.3333 6.33333 36.9    1.82     1.23   628
356 2N354           22.0000    36   58.0000 20.6667   93.333 112.000  42.9667 67.3333 16.0000 5.33333 63.7     2.8     1.33   752
357 2N355           22.0000    36   52.0000 22.0000   94.333 110.000  18.0000 41.6667 11.3333 3.33333 42.8    2.36     2.03   338
358 2N356           22.0000    26   56.3333 21.6667   93.000 107.000  24.7333 42.3333 12.3333 4.00000 57.6    2.59     1.72   450
359 2N357           24.0000    30   53.3333 24.0000   96.000 106.000  31.4333 64.3333 14.3333 7.00000 48.5    2.21     1.74   625
360 2N358           28.0000    22   29.0000  8.3333   83.333 105.000  17.5000 59.6667  6.0000 6.00000 26.4    3.25     1.54   546
361 2N359           24.0000    27   56.3333 23.6667   93.000 103.000  46.4667 96.3333 17.6667 8.00000 44.1    2.14     1.27   881
362 2N360           24.0000    36   41.6667 24.0000   88.667 100.000  17.8333 43.3333 11.3333 4.66667   41    1.77     2.16   427
363 2N361           28.0000    32   14.3333  4.3333   73.333 118.000  19.2000 32.0000  3.3333 2.66667   59    3.49     1.28  1438
364 2N362           26.0000    30   37.3333 16.0000   81.667 117.000  23.4333 43.3333  7.6667 3.33333 54.4     2.4     2.03   689
365 2N363           28.0000    31    1.6667  1.6667   95.667 113.000   1.0333 29.6667  1.6667 3.33333 3.83       1        1   642
366 2N364           22.0000    34   15.6667  5.0000   75.000 112.000  20.4667 33.6667  4.0000 4.00000 58.4     2.9      1.2  1484
367 2N365           24.0000    36   64.0000 18.6667  100.667 110.000  32.3667 62.0000  9.3333 3.66667 55.2    3.67        2   501
368 2N366           28.0000    21   19.0000  9.6667   95.000 107.000  21.7333 40.3333  8.0000 3.33333 48.9    1.81     1.15  1168
369 2N367           24.0000    25   20.0000 12.6667   87.333 106.000  15.2000 30.0000  7.6667 3.66667 51.7    1.65     1.64   760
370 2N368           24.0000    25   22.3333  8.6667   89.333 105.000  13.6000 58.3333  5.0000 5.66667 23.8    2.72     1.78   606
371 2N369           18.0000    30   50.3333 20.6667   90.667 103.000  33.1333 63.0000 10.6667 2.66667 49.4     2.4     1.84   680
372 2N370           24.0000    34   47.0000 17.6667   88.333 100.000  31.5333 55.6667 11.3333 3.66667   54    2.56     1.67   623
373 2N371           22.0000    26   56.6667 20.3333   69.000 118.000  23.2667 33.3333 11.0000 1.66667 71.8    2.66     1.76   377
374 2N372           22.0000    27     .     27.6667   88.333 117.000     .       .     13.6667 3.00000   .       .       3.2     .
375 2N373           22.0000    23   35.3333 15.6667   64.000 113.000  24.2667 36.3333  9.3333 4.00000 65.2    2.22     1.74   786
376 2N374           22.0000    26   45.6667 19.3333   65.000 112.000  15.8333 24.6667 12.3333 4.33333 64.1    2.31     1.67   408
377 2N375           22.0000    34   22.0000  8.6667   79.000 110.000  24.1667 37.0000  5.3333 2.00000 65.9    3.26     1.27  1108
378 2N376           22.0000    21   33.0000 17.3333   76.667 107.000  32.7333 50.0000 11.0000 3.33333 65.1    1.84     1.63  1005
379 2N377           24.6667    18   35.3333 13.3333  106.667 106.000  21.8000 50.3333 12.6667 3.33333 45.5     2.7     1.07   684
380 2N378           18.0000    27   43.0000 16.6667   68.333 105.000  34.4333 52.6667 10.3333 6.66667 65.6    2.64     1.63   841
381 2N379           20.0000    22   43.6667 16.3333   78.000 103.000  34.8333 65.0000 12.0000 3.33333 52.3     2.7     1.46   782
382 2N380           20.0000    27   30.6667 14.3333   78.333 100.000  35.7667 53.3333 12.6667 4.00000   73     2.3      1.1  1198
383 2N381           28.0000    20   29.3333 12.3333   85.000 118.000  25.6667 38.6667  8.6667 2.00000 62.7    2.25     1.37   899
384 2N382           22.0000    27   59.0000 21.6667   95.000 117.000  25.7333 44.0000 10.3333 2.00000 58.2    2.72     2.12   428
385 2N383           32.0000    24   47.3333 18.3333   76.333 113.000  39.1333 57.3333 13.0000 4.33333   68    2.58     1.46   856
386 2N384           26.0000    20   42.6667 16.0000   76.667 112.000  21.2333 36.6667 10.0000 3.00000 58.4    2.74     1.66   504
387 2N385           22.0000    38   64.0000 28.0000  100.000 110.000  27.5000 47.3333  9.6667 2.66667 57.9    2.28     2.96   439
388 2N386           22.0000    32   75.0000 29.3333   97.333 107.000  43.0000 74.0000 15.3333 4.00000 52.2    2.45     1.84   507
389 2N387           20.0000    28   32.6667 11.3333   96.000 106.000  14.7667 55.0000  9.6667 5.00000 28.3    2.91     1.19   497
390 2N388           24.0000    22   73.3333 24.3333   98.333 105.000  57.5667 99.3333 17.6667 5.00000 55.1    3.19     1.34   744
391 2N389              .        .      .       .         .       .         .       .       .       .      .       .        .     .
392 2N390           38.0000    19   19.5000 10.0000   72.500 100.000  10.9500 21.0000  6.5000 2.00000 51.6    1.93     1.56   558
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OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
393	2N391	22	26	45.000	15.6667	88.333	118	34.2333	56.0000	10.0000	3.33333	58.8	2.63	1.63	848
394	2N392	22	34	71.333	25.3333	102.667	117	39.8667	64.6667	13.3333	3.00000	60.1	2.5	1.73	699
395	2N393	29	29	32.333	13.3333	71.000	113	29.3000	56.6667	9.6667	6.66667	52.3	2.47	1.38	925
396	2N394	22	36	42.667	18.3333	79.000	112	24.6667	40.6667	11.0000	3.00000	60.4	2.4	1.73	606
397	2N395	24	34	46.667	19.6667	95.667	110	20.0333	38.3333	9.0000	2.33333	51.7	2.38	2.18	426
398	2N396	22	32	75.333	31.3333	88.333	107	49.0000	73.6667	18.3333	4.66667	63.4	2.37	1.83	607
399	2N397	24	22	31.333	12.6667	89.667	106	18.9667	31.6667	6.3333	3.33333	55.1	2.47	1.92	547
400	2N398	24	21	56.667	19.3333	96.667	103	38.3667	73.6667	10.0000	3.33333	45.6	2.72	1.91	613
401	2N399	32	27	23.000	6.6667	75.000	103	11.6667	20.0000	3.3333	2.66667	58.3	3.32	2.28	613
402	2N400	15	31	89.667	31.3333	80.000	100	39.3333	68.6667	17.0000	5.00000	57.2	2.72	1.97	482
403	2N401	28	30	7.000	5.0000	70.000	118	4.8333	11.3333	3.0000	2.00000	44.5	1.19	1.67	1046
404	2N402	22	32	37.000	18.0000	90.000	117	9.9667	34.6667	12.0000	2.33333	29.6	2.05	1.51	288
405	2N403	29	19	42.000	16.3333	79.000	113	23.9000	42.3333	12.6667	3.00000	55.1	2.63	1.26	552
406	2N404	22	26	44.667	20.3333	88.333	112	16.2667	30.6667	13.3333	4.33333	52.1	2.23	1.49	482
407	2N405	22	24	57.333	24.0000	70.667	110	28.4667	44.6667	14.3333	3.66667	62.7	2.33	1.62	526
408	2N406	22	24	44.000	18.3333	86.667	107	25.5667	43.6667	15.0000	3.33333	58.7	2.39	1.24	583
409	2N407	18	22	61.667	27.0000	87.667	108	39.3667	60.6667	14.0000	4.66667	63.2	2.29	1.95	651
410	2N408	24	16	82.000	29.3333	95.333	103	41.5000	72.3333	16.3333	3.33333	56.4	2.78	1.81	498
411	2N409	17	26	19.000	7.6667	77.333	103	8.8333	25.6667	6.3333	2.00000	33.2	2.78	1.12	476
412	2N410	24	21	38.000	16.0000	76.000	100	17.3000	32.3333	9.6667	2.66667	52.1	2.29	1.65	462
413	2N411	22	26	59.000	23.6667	93.333	118	22.5333	40.0000	9.3333	2.33333	56	2.4	2.56	379
414	2N412	22	24	32.333	14.0000	89.000	117	15.9333	43.6667	9.0000	3.66667	34.7	2.56	1.52	473
415	2N413	22	20	28.333	10.0000	67.333	113	10.2000	22.6667	6.6667	2.33333	47	2.79	1.51	397
416	2N414	22	21	35.000	17.0000	69.333	112	15.3000	30.3333	10.6667	2.66667	49	2.07	1.59	422
417	2N415	22	26	48.000	18.6667	80.333	110	27.9333	53.0000	10.3333	3.66667	51.8	2.55	1.8	581
418	2N416	22	25	67.333	28.3333	89.333	107	39.6667	67.6667	18.6667	4.33333	55.8	2.24	1.51	581
419	2N417	18	25	86.333	32.0000	75.000	106	51.7000	77.6667	17.3333	4.33333	65.5	2.67	1.84	592
420	2N418	17	26	77.000	24.0000	88.333	103	38.3667	67.3333	14.0000	4.33333	59	3.35	1.65	497
421	2N419	18	22	85.333	29.3333	89.000	103	40.3333	81.3333	15.6667	3.66667	51.7	2.87	1.9	492
422	2N420	15	28	72.000	31.0000	94.333	100	35.4333	64.3333	16.3333	4.00000	54.7	2.34	2.04	477
423	2N421	28	30	36.667	14.3333	86.667	118	19.9667	41.0000	7.0000	2.66667	47.4	2.67	2.02	529
424	2N422	22	26	46.000	24.6667	91.667	117	33.2000	64.3333	17.3333	3.33333	52.2	1.92	1.44	724
425	2N423	22	23	48.333	17.0000	78.333	113	24.4667	49.0000	11.3333	4.66667	49.6	2.83	1.5	505
426	2N424	22	26	49.000	18.0000	75.000	112	27.5667	39.0000	9.6667	2.00000	72.1	2.62	1.82	561
427	2N425	22	32	51.333	22.6667	102.333	110	15.8333	29.3333	9.0000	2.66667	54.5	2.18	2.56	309
428	2N426	28	15	104.333	35.6667	85.000	107	36.7667	60.0000	16.6667	4.00000	60.5	3.03	2.01	339
429	2N427	18	25	125.667	49.6667	100.667	106	48.1333	75.3333	24.3333	5.33333	65.2	2.6	2.07	396
430	2N428	17	25	107.667	39.3333	94.333	103	60.3333	92.0000	21.0000	6.00000	65.3	2.7	1.95	582
431	2N429	15	27	50.000	21.3333	80.333	103	20.9667	51.6667	13.3333	8.33333	42.4	2.32	1.79	448
432	2N430	17	25	24.667	8.6667	75.000	100	16.1000	26.6667	5.6667	3.00000	60.2	2.87	1.54	660
433	2N431	22	21	27.667	14.6667	66.667	118	13.7000	26.6667	8.0000	4.33333	51.3	2.16	1.72	516
434	2N432	28	20	39.667	15.0000	78.333	117	21.5667	37.0000	7.6667	3.00000	51.1	2.71	1.91	484
435	2N433	22	24	53.667	22.0000	79.333	113	27.5000	46.3333	9.6667	2.33333	58.5	2.51	2.24	505
436	2N434	22	26	65.667	27.3333	100.000	112	27.6667	54.0000	20.0000	4.00000	52.3	2.37	1.4	501
437	2N435	22	21	64.333	20.6667	97.667	110	21.6000	35.6667	10.6667	3.33333	60.9	3.12	1.9	359
438	2N436	22	34	65.000	23.3333	120.000	107	28.4333	58.3333	10.6667	2.00000	53.6	3	2.57	463
439	2N437	18	22	63.000	27.6667	97.333	106	39.7000	77.3333	16.0000	5.33333	50.2	2.39	1.67	616
440	2N438	24	24	51.667	18.0000	96.667	103	31.6667	66.3333	12.0000	5.33333	43.1	2.63	1.45	662
441	2N439	15	34	88.000	27.6667	96.667	103	36.8000	53.6667	16.6667	4.33333	62.8	3.22	1.7	390
442	2N440	15	33	58.333	23.3333	78.333	100	25.4333	45.0000	10.6667	4.00000	56.4	2.53	2.27	435
443	2N441	22	25	56.333	25.0000	94.333	118	30.4667	61.3333	12.6667	3.00000	49.2	2.12	1.9	695
444	2N442	22	26	101.333	33.6667	85.000	117	32.8333	67.3333	23.6667	6.66667	48.5	2.94	1.46	361
445	2N443	24	32	21.333	14.3333	76.667	113	7.3333	20.3333	7.0000	2.33333	35.9	1.48	2.12	353
446	2N444	26	30	51.000	20.0000	78.333	112	28.7667	46.6667	11.3333	3.66667	57.9	2.34	1.64	482
447	2N445	22	36	92.000	31.6667	80.000	110	29.1000	51.6667	19.6667	4.66667	55.7	2.9	1.6	324
448	2N446	20	20	48.667	15.3333	85.000	107	18.2000	37.3333	9.0000	3.66667	46.4	3.2	1.66	359

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
449	2N447	18	30	77.000	27.0000	112.333	106.000	50.1333	95.0000	17.6667	4.0000	52.5	2.9	1.57	647
450	2N448	24	22	44.333	15.0000	93.667	103.000	37.8667	61.3333	10.6667	3.3333	59.7	2.88	1.42	841
451	2N449	24	23	47.667	14.6667	77.333	103.000	18.3667	36.3333	11.3333	3.3333	50.7	3.23	1.31	403
452	2N450	15	28	59.667	21.0000	83.333	100.000	26.6667	45.3333	13.0000	3.0000	59.2	2.88	1.63	448
453	2N451	22	20	55.000	22.0000	83.333	118.000	25.7000	60.6667	13.3333	4.3333	37.9	2.52	1.65	423
454	2N452	22	18	52.333	23.6667	80.000	117.000	21.9333	40.0000	13.3333	4.0000	53.2	2.26	1.67	433
455	2N453	22	34	69.333	27.6667	95.000	79.667	27.3333	49.3333	10.0000	1.6667	55.8	2.57	2.54	408
456	2N454	22	18	67.500	23.5000	81.000	112.000	20.4500	36.5000	15.5000	4.5000	56.5	2.87	1.5	299
457	2N455	22	36	72.000	30.0000	56.667	110.000	13.3000	29.6667	21.0000	12.6667	43.5	2.45	1.39	182
458	2N456	22	21	23.333	9.3333	80.000	107.000	19.7667	34.6667	6.6667	2.3333	57.3	2.61	1.62	915
459	2N457	18	30	40.667	11.3333	105.000	106.000	32.6000	62.3333	7.6667	2.3333	52.1	3.64	1.52	799
460	2N458	17	29	71.667	20.0000	116.000	103.000	28.4333	63.0000	13.0000	3.0000	42.5	3.61	1.56	399
461	2N459	24	24	41.000	13.3333	104.667	103.000	21.6000	45.0000	8.6667	2.0000	47.3	3.09	1.58	520
462	2N460	17	30	39.667	15.0000	105.000	100.000	22.9000	41.6667	9.0000	2.0000	54.6	2.63	1.66	579
463	2N461	28	30	.	24.6667	101.667	.	.	.	12.0000	2.3333	.	.	2.08	.
464	2N462	28	24	42.667	15.6667	101.667	117.000	22.3333	42.6667	6.6667	1.0000	51.2	2.69	2.32	513
465	2N463	24	24	28.667	10.0000	77.333	113.000	18.8667	36.0000	6.6667	3.6667	55.1	2.94	1.47	806
466	2N464	29	29	46.333	15.6667	110.000	112.000	18.8333	57.6667	12.0000	4.6667	31.8	2.96	1.38	361
467	2N465	22	32	64.000	22.0000	101.667	110.000	13.7333	34.0000	11.3333	3.0000	42.2	2.91	1.93	227
468	2N466	22	26	25.000	6.6667	88.000	107.000	11.4333	24.0000	6.3333	2.6667	47.4	3.79	1.05	460
469	2N467	18	27	55.667	16.3333	113.333	106.000	28.3000	48.3333	11.0000	2.6667	57.7	3.43	1.5	515
470	2N468	24	24	35.000	10.0000	105.333	105.000	16.1333	32.0000	7.0000	2.0000	48.7	3.5	1.45	432
471	2N469	18	30	42.667	14.3333	123.333	103.000	22.0333	48.6667	10.3333	1.3333	43	2.95	1.39	506
472	2N470	24	24	59.667	20.6667	117.333	100.000	36.3333	78.0000	16.6667	3.6667	43.2	2.84	1.32	577
473	2N471	22	28	40.333	15.3333	99.000	118.000	14.1667	36.6667	10.3333	1.3333	35.7	2.55	1.47	363
474	2N472	22	26	86.333	28.6667	98.333	117.000	33.7667	77.6667	18.6667	4.3333	44	2.95	1.39	522
475	2N473	22	24	67.333	20.3333	95.000	113.000	40.8000	80.0000	15.0000	2.6667	51.3	3.33	1.36	606
476	2N474	22	38	52.333	19.6667	110.000	112.000	21.3333	49.6667	12.3333	2.3333	44.5	2.8	1.59	407
477	2N475	22	34	79.667	21.6667	122.333	110.000	37.6000	78.0000	13.3333	3.0000	48.1	3.69	1.63	473
478	2N476	22	36	52.333	16.3333	124.333	107.000	21.9667	60.6667	10.0000	1.3333	35.7	3.34	1.69	411
479	2N477	18	36	71.333	21.6667	127.667	106.000	32.7333	70.0000	13.0000	2.6667	46.7	3.51	1.62	451
480	2N478	24	24	67.667	23.0000	128.333	105.000	34.8667	65.6667	15.0000	3.3333	53	2.94	1.52	540
481	2N479	24	24	92.333	30.3333	128.333	103.000	48.2000	84.6667	21.0000	3.6667	58.8	3.28	1.47	515
482	2N480	17	31	47.000	19.3333	120.667	100.000	28.7333	57.6667	14.0000	2.6667	49.6	2.58	1.41	615
483	2N481	28	30	.	21.3333	106.667	.	.	.	14.0000	2.3333	.	.	1.54	.
484	2N482	28	34	30.333	9.6667	116.667	117.000	14.2333	33.6667	6.0000	1.6667	42.8	3.26	1.56	525
485	2N483	22	26	45.000	17.0000	101.667	113.000	21.9333	48.6667	13.3333	2.6667	43.8	2.91	1.28	485
486	2N484	22	36	77.333	30.0000	120.000	112.000	21.2667	44.3333	14.6667	1.6667	47.2	2.51	1.98	298
487	2N485	32	32	31.000	10.6667	114.000	110.000	8.7000	34.0000	6.0000	3.0000	25	2.74	1.77	277
488	2N486	28	30	75.667	24.6667	120.667	107.000	34.7333	66.0000	14.0000	2.0000	49.1	2.84	1.81	430
489	2N487	18	30	60.667	25.0000	131.667	106.000	25.9667	57.3333	15.3333	2.3333	45.3	2.4	2.02	431
490	2N488	24	34	115.667	37.3333	130.000	105.000	35.6333	72.0000	17.3333	2.3333	48.7	3.13	2.1	311
491	2N489	18	40	47.333	16.0000	126.333	103.000	17.1000	33.6667	10.6667	2.0000	50.1	2.76	1.57	330
492	2N490	24	34	41.333	12.6667	127.333	100.000	22.1000	46.0000	9.3333	2.0000	47.9	3.21	1.44	521
493	2N491	22	28	41.667	15.3333	111.667	118.000	24.7667	49.3333	11.0000	1.6667	49.9	3.06	1.46	619
494	2N492	22	34	77.667	26.6667	108.333	117.000	30.9000	62.3333	12.0000	1.6667	48.4	2.9	2.51	399
495	2N493	22	36	63.667	20.3333	108.333	113.000	35.8333	67.3333	9.3333	1.6667	48.1	2.78	2.09	530
496	2N494	22	38	88.000	30.0000	113.333	112.000	22.8333	50.0000	13.6667	3.0000	45.3	2.87	2.19	282
497	2N495	22	36	47.667	14.3333	116.667	110.000	20.1333	42.3333	8.6667	2.3333	45.2	3.41	1.71	405
498	2N496	22	38	35.333	12.6667	127.667	107.000	10.4667	29.6667	5.0000	1.6667	33.7	2.78	3.03	305
499	2N497	18	27	76.000	26.0000	115.667	106.000	33.5333	59.6667	15.3333	2.6667	54.8	2.92	1.68	424
500	2N498	17	30	88.667	28.6667	124.000	105.000	40.0333	82.3333	20.6667	3.3333	48.8	3.11	1.43	461
501	2N499	18	29	63.000	19.3333	129.000	103.000	30.9667	73.3333	16.0000	3.3333	42.9	3.28	1.2	526
502	2N500	15	35	65.667	19.0000	136.667	100.000	32.2667	71.3333	13.6667	3.3333	45.8	3.35	1.51	517
503	2N501	22	34	70.000	24.6667	116.000	118.000	34.2333	66.6667	15.0000	3.0000	50.4	2.98	1.56	490
504	2N502	22	36	52.000	22.3333	111.667	117.000	26.2333	61.0000	12.0000	2.0000	42.1	2.37	1.75	517

OBS	ACCNBR	EMERG	FLOWER	SEEDS	PODS	HEIGHT	MATURITY	YIELD	TDM	NODES	STALKS	HI	SEEDSPOD	PPNODE	MKWT
505	2N503	29	29	60.667	16.3333	111.667	113	26.3000	51.3333	10.6667	2.66667	50.5	3.6	1.64	510
506	2N504	22	27	66.333	19.6667	107.333	112	28.4333	49.0000	11.0000	1.33333	57.4	3.3	1.87	431
507	2N505	22	26	53.333	18.0000	112.000	110	24.9667	51.0000	12.3333	2.66667	48.3	2.96	1.47	472
508	2N506	22	36	63.000	22.3333	130.000	107	24.1000	57.3333	10.0000	2.33333	41.4	2.77	2.26	398
509	2N507	15	35	71.333	19.6667	127.333	106	35.1000	76.6667	13.0000	2.00000	45.3	3.66	1.58	495
510	2N508	18	32	50.333	17.0000	129.667	105	17.8000	41.6667	7.0000	1.33333	38.9	2.86	2.4	299
511	2N509	18	36	74.333	26.0000	132.667	103	21.6667	63.0000	12.6667	2.66667	35.5	2.85	2.07	317
512	2N510	24	30	49.000	16.6667	125.000	100	27.5667	62.3333	12.3333	2.33333	41.7	2.87	1.38	541
513	2N511	22	34	58.333	17.3333	109.333	118	29.1667	55.6667	11.0000	1.66667	52.1	3.22	1.6	533
514	2N512	22	36	54.667	19.3333	112.333	117	30.3667	65.0000	12.0000	2.66667	41.2	2.78	1.55	466
515	2N513	22	34	67.333	23.0000	113.333	113	30.5667	57.0000	11.0000	1.66667	54.2	2.85	2.13	483
516	2N514	22	34	76.667	28.6667	112.333	112	33.9667	63.6667	18.3333	3.33333	53.3	2.51	1.53	524
517	2N515	22	26	69.333	24.0000	120.000	110	39.5667	72.0000	15.0000	3.00000	54.7	2.88	1.63	602
518	2N516	22	36	64.333	21.6667	121.333	107	24.8667	50.6667	10.6667	2.33333	50.8	3.03	2.12	431
519	2N517	15	35	83.333	22.0000	129.333	104	29.1667	66.0000	13.0000	2.66667	45.3	3.85	1.72	385
520	2N518	18	40	86.333	35.6667	127.333	105	44.6333	90.6667	14.3333	2.66667	46.8	2.56	2.48	488
521	2N519	24	32	73.000	19.0000	125.667	103	25.5667	62.3333	13.0000	2.66667	41.2	3.97	1.51	376
522	2N520	17	31	60.000	16.6667	104.333	100	18.9333	44.6667	9.6667	2.00000	42.7	3.76	1.75	316
523	2N521	22	36	.	16.3333	103.333	118	.	.	8.6667	1.66667	.	.	1.89	.
524	2N522	22	36	41.667	15.3333	106.667	117	18.5333	43.0000	9.0000	2.66667	43.7	2.73	1.71	454
525	2N523	32	32	40.000	17.3333	109.333	113	17.6000	40.0000	9.6667	2.00000	43.1	2.21	1.89	444
526	2N524	29	35	35.000	12.6667	117.333	112	15.8333	34.0000	6.0000	1.00000	46.9	2.76	2.08	464
527	2N525	32	28	43.667	17.6667	104.000	110	18.7000	39.3333	11.3333	2.66667	45.9	2.38	1.54	458
528	2N526	32	26	42.667	15.0000	118.333	107	19.1667	48.6667	10.0000	2.66667	37.8	2.65	1.47	511
529	2N527	24	36	50.333	16.0000	115.000	106	28.3333	52.0000	9.3333	1.66667	51.9	3.35	1.8	523
530	2N528	.	.	.	.	.	.	.	.	.	.	.	.	.	.
531	2N529	24	36	29.000	10.0000	123.333	103	11.4667	37.0000	6.3333	1.00000	29.9	2.9	1.57	376
532	2N530	24	32	50.000	15.3333	109.333	100	21.3000	47.0000	9.6667	1.66667	41.5	3.16	1.55	409
533	2N531	22	36	87.333	37.3333	108.333	118	45.9667	96.3333	22.0000	3.33333	47.5	2.55	1.66	517
534	2N532	22	38	58.667	21.3333	111.667	117	28.2333	53.0000	10.6667	1.33333	53.6	3.01	1.96	473
535	2N533	29	27	106.000	34.0000	105.000	113	29.3000	65.6667	17.3333	3.00000	43.4	3.12	1.81	300
536	2N534	22	38	90.000	35.6667	117.667	112	36.9333	77.6667	19.0000	3.00000	46	2.45	1.85	411
537	2N535	22	36	54.000	20.3333	108.333	110	20.6000	47.0000	10.6667	2.33333	45.6	2.69	1.93	376

APPENDIX C. DISCRIMINANT ANALYSIS TABLE

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DISCRIMINANT ANALYSIS     CLASSIFICATION RESULTS FOR CALIBRATION DATA: SAVE.GROUP80

                                                  POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:

                  ACCNBR    FROM    CLASSIFIED        CZECH    EGYPT       UK
                            GROUP   INTO GROUP

          2N119             UK      CZECH       *    0.6705   0.2837   0.0457
          2N120                     EGYPT       *    0.2506   0.7271   0.0223
          2N121                     CZECH       *    0.5120   0.4289   0.0590
          2N122                     CZECH       *    0.9270   0.0579   0.0151
          2N123                     EGYPT       *    0.0597   0.8939   0.0464
          2N124                     EGYPT       *    0.1627   0.7960   0.0414
          2N125                     EGYPT       *    0.0500   0.7423   0.2077
          2N126                     EGYPT       *    0.0998   0.8150   0.0852
          2N127                     CZECH       *    0.5036   0.3629   0.1335
          2N128                     CZECH       *    0.4431   0.3681   0.1888
          2N129                     EGYPT       *    0.0005   0.8559   0.1437
          2N130                     CZECH       *    0.8304   0.1411   0.0285
          2N131                     EGYPT       *    0.4140   0.4785   0.1075
          2N133                     EGYPT       *    0.0427   0.9567   0.0006
          2N138             CZECH   EGYPT       *    0.3512   0.5733   0.0754
          2N149             EGYPT   CZECH       *    0.5700   0.3950   0.0350
          2N153                     EGYPT       *    0.1053   0.8125   0.0822
          2N159             EGYPT   UK          *    0.0000   0.0493   0.9507
          2N162             EGYPT   UK          *    0.0000   0.0995   0.9005
          2N164                     CZECH       *    0.9966   0.0019   0.0016
          2N166             EGYPT   UK          *    0.0000   0.0010   0.9990
          2N178             CZECH   UK          *    0.0000   0.4238   0.5762
          2N179             CZECH   UK          *    0.0000   0.1250   0.8750
          2N181             EGYPT   CZECH       *    0.7868   0.1931   0.0201
          2N188             UK      EGYPT       *    0.0000   0.9560   0.0440
          2N195                     EGYPT       *    0.1310   0.8253   0.0438
          2N196                     EGYPT       *    0.0057   0.9781   0.0162
          2N197                     CZECH       *    0.4785   0.4217   0.0998
          2N198                     CZECH       *    0.9290   0.0664   0.0047
          2N199                     EGYPT       *    0.0190   0.9784   0.0026
          2N200                     CZECH       *    0.9635   0.0174   0.0190
          2N201                     EGYPT       *    0.0332   0.8817   0.0851
          2N202                     EGYPT       *    0.2683   0.6982   0.0335
          2N203             UK      EGYPT       *    0.2267   0.6566   0.1167
          2N214                     EGYPT       *    0.0005   0.7965   0.2030
          2N215                     CZECH       *    0.9285   0.0691   0.0024
          2N216                     EGYPT       *    0.0067   0.9050   0.0883
          2N217                     EGYPT       *    0.2825   0.6428   0.0747
          2N218                     CZECH       *    0.8525   0.1399   0.0077
          2N219             UK      EGYPT       *    0.1968   0.6696   0.1336
          2N220             UK      CZECH       *    0.9387   0.0563   0.0050
          2N221             UK      EGYPT       *    0.2873   0.6579   0.0548
          2N222             UK      CZECH       *    0.5659   0.3399   0.0942
          2N223             UK      CZECH       *    0.7769   0.1782   0.0449
          2N224             UK      EGYPT       *    0.0325   0.9391   0.0284
          2N227             UK      CZECH       *    0.6207   0.2817   0.0976
          2N229                     CZECH       *    0.6522   0.2753   0.0725
          2N230             EGYPT   UK          *    0.0000   0.0081   0.9919
          2N232             EGYPT   UK          *    0.0046   0.4012   0.5942
          2N243             EGYPT   CZECH       *    0.4874   0.4867   0.0259
          2N251             EGYPT   CZECH       *    0.6096   0.3291   0.0614
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DISCRIMINANT ANALYSIS     CLASSIFICATION RESULTS FOR CALIBRATION DATA: SAVE.GROUP80
                                                     POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:

                    ACCNBR    FROM   CLASSIFIED      CZECH   EGYPT      UK
                             GROUP   INTO GROUP

          2N255              EGYPT   UK         *   0.0002  0.4797  0.5201
          2N284              UK      EGYPT      *   0.0160  0.6856  0.2984
          2N285              UK      EGYPT      *   0.0296  0.9071  0.0633
          2N286              UK      EGYPT      *   0.0025  0.9073  0.0902
          2N287              UK      EGYPT      *   0.0444  0.8720  0.0836
          2N288              UK      EGYPT      *   0.1159  0.8063  0.0778
          2N289              UK      EGYPT      *   0.0006  0.7662  0.2332
          2N291                      EGYPT      *   0.0683  0.8598  0.0718
          2N295              CZECH   EGYPT      *   0.1531  0.8257  0.0211
          2N298              EGYPT   CZECH      *   0.4792  0.4231  0.0977
          2N300              CZECH   EGYPT      *   0.3174  0.6767  0.0060
          2N301              CZECH   EGYPT      *   0.2874  0.6489  0.0637
          2N302              CZECH   EGYPT      *   0.1902  0.7248  0.0850
          2N315              UK      EGYPT      *   0.4402  0.4916  0.0682
          2N316              UK      EGYPT      *   0.1714  0.7388  0.0898
          2N317              UK      CZECH      *   0.6690  0.2611  0.0700
          2N318              UK      EGYPT      *   0.1430  0.8118  0.0452
          2N322              UK      EGYPT      *   0.1755  0.7118  0.1127
          2N323              UK      EGYPT      *   0.4307  0.4331  0.1361
          2N324              UK      EGYPT      *   0.0118  0.9117  0.0765
          2N325              EGYPT   CZECH      *   0.6032  0.3658  0.0310
          2N330              EGYPT   UK         *   0.1107  0.3956  0.4937
          2N331              EGYPT   UK         *   0.0000  0.4678  0.5322
          2N333              EGYPT   CZECH      *   0.8110  0.1853  0.0036
          2N335              EGYPT   CZECH      *   0.5542  0.4068  0.0389
          2N337              EGYPT   CZECH      *   0.5420  0.3904  0.0676
          2N339              EGYPT   CZECH      *   0.7283  0.2620  0.0096
          2N341              EGYPT   CZECH      *   0.6435  0.3039  0.0526
          2N342              EGYPT   CZECH      *   0.7205  0.2188  0.0607
          2N344              EGYPT   CZECH      *   0.6313  0.2895  0.0793
          2N355              EGYPT   CZECH      *   0.6227  0.3114  0.0659
          2N356              EGYPT   CZECH      *   0.4808  0.4505  0.0687
          2N363              EGYPT   UK         *   0.0000  0.3774  0.6226
          2N365              EGYPT   CZECH      *   0.5361  0.4025  0.0614
          2N372              EGYPT   CZECH      *   0.7214  0.2121  0.0665
          2N374              EGYPT   CZECH      *   0.4781  0.4456  0.0764
          2N375              EGYPT   UK         *   0.0001  0.4377  0.5623
          2N384                      CZECH      *   0.5283  0.4100  0.0617
          2N385              EGYPT   CZECH      *   0.8540  0.1243  0.0217
          2N387              UK      EGYPT      *   0.3072  0.6078  0.0850
          2N388              UK      EGYPT      *   0.2254  0.6754  0.0992
          2N389              EGYPT   CZECH      *   0.5860  0.3428  0.0712
          2N391              EGYPT   CZECH      *   0.8391  0.1442  0.0167
          2N392              EGYPT   CZECH      *   0.5473  0.3796  0.0731
          2N393              UK      EGYPT      *   0.2852  0.6196  0.0952
          2N394              UK      EGYPT      *   0.3779  0.5502  0.0719
          2N396              UK      CZECH      *   0.7107  0.2428  0.0464
          2N397                      EGYPT      *   0.3256  0.5702  0.1042
          2N399                      EGYPT      *   0.0728  0.8840  0.0432
          2N403              EGYPT   CZECH      *   0.4929  0.4377  0.0694
          2N407              EGYPT   CZECH      *   0.5546  0.4360  0.0094
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DISCRIMINANT ANALYSIS     CLASSIFICATION RESULTS FOR CALIBRATION DATA: SAVE.GROUP80

                                                POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:
                 ACCNBR     FROM    CLASSIFIED        CZECH   EGYPT      UK
                           GROUP    INTO GROUP

        2N408              EGYPT    CZECH       *    0.5597  0.4033  0.0370
        2N409              EGYPT    CZECH       *    0.5695  0.3806  0.0500
        2N416              EGYPT    UK          *    0.0000  0.0565  0.9435
        2N421              EGYPT    CZECH       *    0.7199  0.2597  0.0204
        2N423              EGYPT    CZECH       *    0.5465  0.3978  0.0557
        2N424              EGYPT    CZECH       *    0.4343  0.4280  0.1376
        2N429              EGYPT    CZECH       *    0.4998  0.4454  0.0548
        2N433              EGYPT    CZECH       *    0.5481  0.3745  0.0773
        2N434              EGYPT    CZECH       *    0.5966  0.3609  0.0425
        2N436              EGYPT    CZECH       *    0.6321  0.3140  0.0539
        2N438              EGYPT    UK          *    0.0000  0.0040  0.9960
        2N440              EGYPT    CZECH       *    0.7787  0.2197  0.0016
        2N444              UK       EGYPT       *    0.3729  0.5519  0.0752
        2N448              EGYPT    CZECH       *    0.6293  0.3263  0.0444
        2N449              EGYPT    CZECH       *    0.4892  0.4420  0.0688
        2N450              EGYPT    CZECH       *    0.6094  0.3458  0.0448
        2N453              EGYPT    CZECH       *    0.5767  0.3940  0.0294
        2N458              UK       EGYPT       *    0.0761  0.8280  0.0959
        2N459              UK       CZECH       *    0.9138  0.0663  0.0199
        2N460              UK       EGYPT       *    0.0646  0.8434  0.0920
        2N461              UK       EGYPT       *    0.0029  0.7323  0.2648
        2N462              UK       EGYPT       *    0.1374  0.7126  0.1500
        2N463              UK       CZECH       *    0.5459  0.3755  0.0786
        2N464              UK       CZECH       *    0.8108  0.1249  0.0642
        2N465              UK       EGYPT       *    0.3107  0.6112  0.0780
        2N466                       EGYPT       *    0.0010  0.8882  0.1109
        2N467                       UK          *    0.0003  0.3844  0.6152
        2N468                       EGYPT       *    0.0279  0.7890  0.1831
        2N480              CZECH    EGYPT       *    0.4768  0.4943  0.0289
        2N483              CZECH    EGYPT       *    0.4221  0.5137  0.0642
        2N490              CZECH    EGYPT       *    0.3876  0.5829  0.0295
        2N494              CZECH    EGYPT       *    0.1796  0.5817  0.2387
        2N496              CZECH    EGYPT       *    0.0211  0.9208  0.0581
        2N497              CZECH    EGYPT       *    0.3069  0.6592  0.0340
        2N508              CZECH    EGYPT       *    0.0027  0.9822  0.0151
        2N510              CZECH    EGYPT       *    0.2962  0.7038  0.0000
        2N518              CZECH    EGYPT       *    0.0614  0.9345  0.0042

                           * MISCLASSIFIED OBSERVATION
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DISCRIMINANT ANALYSIS     CLASSIFICATION RESULTS FOR CALIBRATION DATA: SAVE.GROUP81

                                                    POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:

                    ACCNBR     FROM    CLASSIFIED      CZECH   EGYPT      UK
                               GROUP   INTO GROUP

          2N064                CZECH   EGYPT      *   0.1747  0.5592  0.2661
          2N067                CZECH   EGYPT      *   0.1731  0.4594  0.3676
          2N101                CZECH   EGYPT      *   0.1431  0.5234  0.3335
          2N102                CZECH   EGYPT      *   0.1457  0.5033  0.3510
          2N104                CZECH   EGYPT      *   0.2930  0.5186  0.1884
          2N106                CZECH   UK         *   0.2045  0.2452  0.5503
          2N110                CZECH   EGYPT      *   0.2704  0.5777  0.1519
          2N112                CZECH   EGYPT      *   0.1943  0.6345  0.1712
          2N142                CZECH   EGYPT      *   0.0159  0.5882  0.3959
          2N178                CZECH   EGYPT      *   0.3455  0.6511  0.0034
          2N179                CZECH   EGYPT      *   0.0069  0.5939  0.3992
          2N295                CZECH   EGYPT      *   0.2671  0.4953  0.2376
          2N300                CZECH   EGYPT      *   0.0008  0.9838  0.0154
          2N301                CZECH   EGYPT      *   0.0209  0.7521  0.2270
          2N302                CZECH   EGYPT      *   0.0229  0.9235  0.0536
          2N303                CZECH   EGYPT      *   0.1504  0.6187  0.2309
          2N470                CZECH   EGYPT      *   0.4504  0.4766  0.0730
          2N471                CZECH   EGYPT      *   0.3766  0.4430  0.1804
          2N478                CZECH   EGYPT      *   0.4365  0.4564  0.1071
          2N484                CZECH   UK         *   0.1859  0.2090  0.6051
          2N488                CZECH   UK         *   0.2270  0.1347  0.6383
          2N494                CZECH   UK         *   0.3199  0.1155  0.5645
          2N497                CZECH   EGYPT      *   0.3939  0.4312  0.1748
          2N523                CZECH   EGYPT      *   0.3716  0.3788  0.2496
          2N525                CZECH   EGYPT      *   0.3266  0.4936  0.1797
          2N533                CZECH   EGYPT      *   0.0886  0.6234  0.2880
          2N034                EGYPT   UK         *   0.1179  0.2738  0.6084
          2N038                EGYPT   UK         *   0.0526  0.1253  0.8221
          2N039                EGYPT   UK         *   0.3944  0.1146  0.4910
          2N040                EGYPT   UK         *   0.1375  0.0948  0.7677
          2N041                EGYPT   CZECH      *   0.5962  0.1710  0.2328
          2N042                EGYPT   UK         *   0.0001  0.0158  0.9842
          2N043                EGYPT   CZECH      *   0.3947  0.2890  0.3163
          2N044                EGYPT   CZECH      *   0.5137  0.2217  0.2646
          2N049                EGYPT   CZECH      *   0.6139  0.2139  0.1722
          2N053                EGYPT   CZECH      *   0.6760  0.1393  0.1847
          2N055                EGYPT   UK         *   0.1125  0.3258  0.5617
          2N118                EGYPT   CZECH      *   0.4986  0.0911  0.4103
          2N148                EGYPT   CZECH      *   0.4378  0.3740  0.1882
          2N165                EGYPT   CZECH      *   0.6728  0.1363  0.1909
          2N166                EGYPT   UK         *   0.0582  0.1873  0.7545
          2N168                EGYPT   CZECH      *   0.5559  0.2098  0.2343
          2N173                EGYPT   CZECH      *   0.6469  0.1673  0.1857
          2N175                EGYPT   CZECH      *   0.4050  0.3861  0.2089
          2N206                EGYPT   CZECH      *   0.5754  0.1988  0.2258
          2N208                EGYPT   CZECH      *   0.7061  0.1772  0.1167
          2N234                EGYPT   CZECH      *   0.3859  0.3224  0.2917
          2N236                EGYPT   CZECH      *   0.6843  0.1027  0.2130
          2N237                EGYPT   UK         *   0.0023  0.1822  0.8155
          2N250                EGYPT   CZECH      *   0.6721  0.1119  0.2160
          2N255                EGYPT   UK         *   0.1529  0.3773  0.4697
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DISCRIMINANT ANALYSIS     CLASSIFICATION RESULTS FOR CALIBRATION DATA: SAVE.GROUP81

                                                POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:

                 ACCNBR    FROM     CLASSIFIED         CZECH     EGYPT       UK
                           GROUP    INTO GROUP

       2N257               EGYPT    UK          *    0.1255    0.3933    0.4812
       2N267               EGYPT    CZECH       *    0.6926    0.2062    0.1012
       2N277               EGYPT    CZECH       *    0.5195    0.1714    0.3091
       2N280               EGYPT    CZECH       *    0.6628    0.1999    0.1373
       2N282               EGYPT    CZECH       *    0.5519    0.2132    0.2350
       2N296               EGYPT    CZECH       *    0.5966    0.1245    0.2789
       2N298               EGYPT    CZECH       *    0.5759    0.1977    0.2264
       2N307               EGYPT    CZECH       *    0.5352    0.4075    0.0574
       2N308               EGYPT    UK          *    0.0100    0.0567    0.9334
       2N312               EGYPT    CZECH       *    0.5493    0.3089    0.1418
       2N319               EGYPT    UK          *    0.1915    0.0852    0.7233
       2N332               EGYPT    CZECH       *    0.6026    0.1681    0.2294
       2N336               EGYPT    CZECH       *    0.4702    0.4470    0.0828
       2N337               EGYPT    CZECH       *    0.6378    0.1805    0.1817
       2N338               EGYPT    UK          *    0.0501    0.4500    0.4999
       2N340               EGYPT    CZECH       *    0.4992    0.3614    0.1394
       2N342               EGYPT    CZECH       *    0.4567    0.3393    0.2041
       2N344               EGYPT    CZECH       *    0.3891    0.2904    0.3205
       2N348               EGYPT    CZECH       *    0.5830    0.1620    0.2550
       2N355               EGYPT    CZECH       *    0.4767    0.2030    0.3204
       2N360               EGYPT    UK          *    0.1870    0.3692    0.4439
       2N365               EGYPT    CZECH       *    0.5936    0.0743    0.3321
       2N370               EGYPT    CZECH       *    0.3889    0.3385    0.2726
       2N385               EGYPT    UK          *    0.2596    0.2504    0.4900
       2N386               EGYPT    CZECH       *    0.6484    0.1965    0.1551
       2N395               EGYPT    CZECH       *    0.4401    0.2874    0.2725
       2N400               EGYPT    CZECH       *    0.4813    0.2585    0.2602
       2N409               EGYPT    CZECH       *    0.4584    0.2992    0.2424
       2N418               EGYPT    CZECH       *    0.4848    0.3198    0.1954
       2N421               EGYPT    CZECH       *    0.5056    0.2796    0.2148
       2N427               EGYPT    UK          *    0.0001    0.4981    0.5018
       2N436               EGYPT    CZECH       *    0.6517    0.1286    0.2197
       2N439               EGYPT    UK          *    0.2906    0.2194    0.4900
       2N440               EGYPT    CZECH       *    0.4161    0.2987    0.2852
       2N445               EGYPT    UK          *    0.1706    0.1791    0.6503
       2N447               EGYPT    CZECH       *    0.6483    0.2391    0.1126
       2N453               EGYPT    UK          *    0.3259    0.2779    0.3962
       2N455               EGYPT    UK          *    0.0264    0.2454    0.7282
       2N457               EGYPT    UK          *    0.1031    0.2409    0.6560
       2N001               UK       CZECH       *    0.6572    0.1405    0.2023
       2N003               UK       CZECH       *    0.6043    0.0977    0.2979
       2N004               UK       EGYPT       *    0.0290    0.5269    0.4441
       2N005               UK       CZECH       *    0.5701    0.2894    0.1405
       2N006               UK       CZECH       *    0.4464    0.2598    0.2938
       2N007               UK       CZECH       *    0.3824    0.3330    0.2847
       2N009               UK       CZECH       *    0.5416    0.1020    0.3564
       2N010               UK       CZECH       *    0.7373    0.0990    0.1637
       2N011               UK       EGYPT       *    0.0766    0.7991    0.1243
       2N012               UK       EGYPT       *    0.2310    0.3928    0.3761
       2N015               UK       CZECH       *    0.5094    0.1924    0.2982
       2N016               UK       EGYPT       *    0.3265    0.4373    0.2362
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DISCRIMINANT ANALYSIS     CLASSIFICATION RESULTS FOR CALIBRATION DATA: SAVE.GROUP81

                                                 POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:

                    ACCNBR    FROM    CLASSIFIED      CZECH    EGYPT      UK
                              GROUP   INTO GROUP

           2N020              UK      EGYPT      *   0.0486   0.7977   0.1537
           2N021              UK      CZECH      *   0.7051   0.0949   0.2001
           2N022              UK      CZECH      *   0.3902   0.2250   0.3848
           2N023              UK      CZECH      *   0.3683   0.3148   0.3169
           2N024              UK      CZECH      *   0.4529   0.1974   0.3497
           2N025              UK      EGYPT      *   0.2788   0.3893   0.3318
           2N026              UK      CZECH      *   0.6990   0.1025   0.1985
           2N029              UK      CZECH      *   0.6713   0.1197   0.2090
           2N031              UK      EGYPT      *   0.0057   0.6189   0.3755
           2N068              UK      EGYPT      *   0.1400   0.6811   0.1789
           2N069              UK      CZECH      *   0.6779   0.0622   0.2599
           2N070              UK      CZECH      *   0.6516   0.0507   0.2977
           2N072              UK      CZECH      *   0.5599   0.1520   0.2881
           2N073              UK      CZECH      *   0.5293   0.1572   0.3135
           2N074              UK      CZECH      *   0.5960   0.1979   0.2062
           2N080              UK      EGYPT      *   0.0003   0.9717   0.0279
           2N082              UK      EGYPT      *   0.2131   0.5646   0.2223
           2N083              UK      EGYPT      *   0.0583   0.6732   0.2685
           2N084              UK      EGYPT      *   0.2253   0.5676   0.2071
           2N085              UK      EGYPT      *   0.0307   0.7975   0.1717
           2N087              UK      CZECH      *   0.6092   0.1746   0.2162
           2N088              UK      CZECH      *   0.4436   0.3541   0.2022
           2N089              UK      EGYPT      *   0.0439   0.7886   0.1675
           2N092              UK      CZECH      *   0.4376   0.2856   0.2768
           2N094              UK      EGYPT      *   0.2625   0.4255   0.3120
           2N095              UK      CZECH      *   0.5121   0.2286   0.2593
           2N097              UK      CZECH      *   0.6124   0.1879   0.1997
           2N098              UK      CZECH      *   0.7867   0.1180   0.0954
           2N099              UK      CZECH      *   0.6563   0.1505   0.1932
           2N114              UK      EGYPT      *   0.2092   0.6082   0.1826
           2N117              UK      CZECH      *   0.5113   0.2905   0.1982
           2N119              UK      CZECH      *   0.7315   0.1095   0.1591
           2N143              UK      EGYPT      *   0.1879   0.5929   0.2192
           2N186              UK      EGYPT      *   0.1380   0.5424   0.3196
           2N187              UK      EGYPT      *   0.0406   0.6029   0.3564
           2N188              UK      EGYPT      *   0.0000   0.7799   0.2201
           2N219              UK      CZECH      *   0.5778   0.1238   0.2984
           2N220              UK      CZECH      *   0.4928   0.1137   0.3935
           2N221              UK      CZECH      *   0.7210   0.0666   0.2124
           2N222              UK      CZECH      *   0.5885   0.1360   0.2754
           2N223              UK      CZECH      *   0.6634   0.1080   0.2286
           2N283              UK      EGYPT      *   0.1107   0.7044   0.1849
           2N284              UK      EGYPT      *   0.0032   0.8609   0.1360
           2N285              UK      CZECH      *   0.5689   0.1045   0.3266
           2N286              UK      EGYPT      *   0.0107   0.7925   0.1967
           2N287              UK      EGYPT      *   0.0000   0.9855   0.0145
           2N288              UK      EGYPT      *   0.1403   0.5194   0.3403
           2N289              UK      CZECH      *   0.5822   0.2026   0.2152
           2N315              UK      EGYPT      *   0.0273   0.8127   0.1600
           2N316              UK      EGYPT      *   0.1457   0.7905   0.0638
           2N318              UK      EGYPT      *   0.0005   0.8590   0.1405
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DISCRIMINANT ANALYSIS     CLASSIFICATION RESULTS FOR CALIBRATION DATA: SAVE.GROUP81

                                                    POSTERIOR PROBABILITY OF MEMBERSHIP IN GROUP:
                  ACCNBR    FROM    CLASSIFIED          CZECH   EGYPT      UK
                            GROUP   INTO GROUP

        2N321               UK      EGYPT        *   0.0001  0.8796  0.1203
        2N324               UK      EGYPT        *   0.0801  0.8236  0.0963
        2N387               UK      CZECH        *   0.4311  0.2975  0.2715
        2N388               UK      CZECH        *   0.4711  0.4593  0.0696
        2N393               UK      EGYPT        *   0.0105  0.8798  0.1097
        2N394               UK      EGYPT        *   0.1964  0.5563  0.2472
        2N396               UK      CZECH        *   0.4374  0.3297  0.2329
        2N444               UK      CZECH        *   0.4077  0.3965  0.1958
        2N458               UK      CZECH        *   0.6344  0.1461  0.2195
        2N459               UK      CZECH        *   0.4571  0.3394  0.2035
        2N460               UK      CZECH        *   0.4087  0.3674  0.2239
        2N462               UK      EGYPT        *   0.3073  0.5485  0.1442
        2N463               UK      EGYPT        *   0.0228  0.8092  0.1679
        2N464               UK      CZECH        *   0.4240  0.3975  0.1785
        2N465               UK      EGYPT        *   0.2805  0.3602  0.3592

                         * MISCLASSIFIED OBSERVATION
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                              MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD

STEP 1    VARIABLE TDM ENTERED          R SQUARE = 0.76907072       C(P) =   606.16140964

                                  DF              SUM OF SQUARES         MEAN SQUARE            F        PROB>F

                 REGRESSION        1              52223.08761127      52223.08761127      1635.19        0.0001
                 ERROR           491              15681.05433770         31.93697421
                 TOTAL           492              67904.14194897

                                 B VALUE               STD ERROR         TYPE II SS             F        PROB>F

                 INTERCEPT    -3.23710797
                 TDM           0.54131076             0.01338635      52223.08761127      1635.19        0.0001
---------------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  1 VARIABLE MODEL FOUND.

STEP 2    VARIABLE FLOWER ENTERED       R SQUARE = 0.79832826       C(P) =   469.41016939

                                  DF              SUM OF SQUARES         MEAN SQUARE            F        PROB>F

                 REGRESSION        2              54209.79543223      27104.89771612       969.85        0.0001
                 ERROR           490              13694.34651673         27.94764595
                 TOTAL           492              67904.14194897

                                 B VALUE               STD ERROR         TYPE II SS             F        PROB>F

                 INTERCEPT     7.51769551
                 TDM           0.54391867             0.01252623      52695.34545053      1885.50        0.0001
                 FLOWER       -0.35927915             0.04261256       1986.70782096        71.09        0.0001
---------------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  2 VARIABLE MODEL FOUND.

STEP 3    VARIABLE PODS ENTERED         R SQUARE = 0.81841761       C(P) =   376.13824172

                                  DF              SUM OF SQUARES         MEAN SQUARE            F        PROB>F

                 REGRESSION        3              55573.94528405      18524.64842802       734.66        0.0001
                 ERROR           489              12330.19666491         25.21512610
                 TOTAL           492              67904.14194897

                                 B VALUE               STD ERROR         TYPE II SS             F        PROB>F

                 INTERCEPT     8.33681794
                 TDM           0.48100102             0.01465391      27167.26871679      1077.42        0.0001
                 PODS          0.23765463             0.03231066       1364.14985182        54.10        0.0001
                 FLOWER       -0.43509533             0.04176769       2736.20760718       108.51        0.0001
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                                     MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD
STEP 4    NODES REPLACED BY PODS           R SQUARE = 0.84413267       C(P) =   256.18684353
                                       DF             SUM OF SQUARES          MEAN SQUARE             F     PROB>F

                   REGRESSION           4             57320.10478596       14330.02619649        660.72     0.0001
                   ERROR              488             10584.03716300          21.68860074
                   TOTAL              492             67904.14194897

                                         B VALUE           STD ERROR           TYPE II SS             F     PROB>F

                   INTERCEPT        -19.54905235
                   TDM                0.36613348          0.01641591       10788.98824977        497.45     0.0001
                   PODS               0.46150124          0.03652538        3462.48339363        159.65     0.0001
                   MKWT               0.01297949          0.00095744        3985.87173818        183.78     0.0001
                   SEEDSPOD           3.49890790          0.40239212        1639.82545561         75.61     0.0001
------------------------------------------------------------------------------------------------------------------

STEP 4    SEEDSPOD REPLACED BY FLOWER      R SQUARE = 0.84597083       C(P) =   247.46953186
                                       DF             SUM OF SQUARES          MEAN SQUARE             F     PROB>F

                   REGRESSION           4             57444.92349920       14361.23087480        670.06     0.0001
                   ERROR              488             10459.21844977          21.43282469
                   TOTAL              492             67904.14194897

                                         B VALUE           STD ERROR           TYPE II SS             F     PROB>F

                   INTERCEPT          0.91923235
                   TDM                0.41938541          0.01503385       16678.83570132        778.19     0.0001
                   PODS               0.41839598          0.03551900        2973.94502362        138.76     0.0001
                   FLOWER            -0.35745554          0.03939428        1764.64416884         82.33     0.0001
                   MKWT               0.00866290          0.00092719        1870.97821515         87.29     0.0001
------------------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  4 VARIABLE MODEL FOUND.

STEP 5    VARIABLE SEEDSPOD ENTERED        R SQUARE = 0.87049787       C(P) =   133.15225681
                                       DF             SUM OF SQUARES          MEAN SQUARE             F     PROB>F

                   REGRESSION           5             59110.41088259       11822.08217652        654.71     0.0001
                   ERROR              487              8793.73106637          18.05694264
                   TOTAL              492             67904.14194897

                                         B VALUE           STD ERROR           TYPE II SS             F     PROB>F

                   INTERCEPT         -8.19218562
                   TDM                0.36336999          0.01498117       10623.09003557        588.31     0.0001
                   PODS               0.49044272          0.03345388        3880.85841264        214.92     0.0001
                   FLOWER            -0.36005535          0.03615994        1790.30609663         99.15     0.0001
                   MKWT               0.01121181          0.00089147        2856.18443274        158.18     0.0001
                   SEEDSPOD           3.52627796          0.36717067        1665.48738340         92.24     0.0001
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THE ABOVE MODEL IS THE BEST  5 VARIABLE MODEL FOUND.
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                              MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD

STEP 6    VARIABLE HEIGHT ENTERED          R SQUARE = 0.87486621        C(P) =    114.43577043

                                      DF           SUM OF SQUARES        MEAN SQUARE              F       PROB>F

                    REGRESSION         6           59407.03962221      9901.17327037         566.31       0.0001
                    ERROR            486            8497.10232676        17.48374964
                    TOTAL            492           67904.14194897

                                        B VALUE         STD ERROR        TYPE II SS               F       PROB>F

                    INTERCEPT       -5.43886065
                    TDM              0.38683044        0.01580355    10475.30824724          599.15       0.0001
                    PODS             0.47055838        0.03327072     3497.33569333          200.03       0.0001
                    FLOWER          -0.30845073        0.03772266     1168.96534669           66.86       0.0001
                    MKWT             0.01045478        0.00089625     2379.06382652          136.07       0.0001
                    SEEDSPOD         3.86910030        0.37075873     1904.02126309          108.90       0.0001
                    HEIGHT          -0.06054846        0.01469988      296.62873961           16.97       0.0001
-----------------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  6 VARIABLE MODEL FOUND.

STEP 7    VARIABLE STALKS ENTERED          R SQUARE = 0.88369172        C(P) =     74.58157898

                                      DF           SUM OF SQUARES        MEAN SQUARE              F       PROB>F

                    REGRESSION         7           60006.32831570      8572.33261653         526.42       0.0001
                    ERROR            485            7897.81363327        16.28415182
                    TOTAL            492           67904.14194897

                                        B VALUE         STD ERROR        TYPE II SS               F       PROB>F

                    INTERCEPT        1.58229583
                    TDM              0.43005162        0.01683378    10627.79324253          652.65       0.0001
                    PODS             0.43341272        0.03268767     2862.86326561          175.81       0.0001
                    FLOWER          -0.29051501        0.03652540     1030.17810600           63.26       0.0001
                    MKWT             0.00989430        0.00086988     2106.78483935          129.38       0.0001
                    SEEDSPOD         3.08021477        0.38071116     1065.94776240           65.46       0.0001
                    HEIGHT          -0.10355403        0.01585923      694.28044636           42.64       0.0001
                    STALKS          -0.71600757        0.11802721      599.28869349           36.80       0.0001
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THE ABOVE MODEL IS THE BEST  7 VARIABLE MODEL FOUND.
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                         MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD

STEP 1    VARIABLE TDM ENTERED           R SQUARE = 0.71517049       C(P) =   644.12932207

                                  DF          SUM OF SQUARES        MEAN SQUARE             F       PROB>F

                 REGRESSION        1       220893.23817022    220893.23817022        1245.39       0.0001
                 ERROR           496        87974.70669401       177.36836027
                 TOTAL           497       308867.94486423

                                   B VALUE        STD ERROR         TYPE II SS              F       PROB>F

                 INTERCEPT      4.72799862
                 TDM            0.45652194       0.01293625    220893.23817022        1245.39       0.0001
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THE ABOVE MODEL IS THE BEST  1 VARIABLE MODEL FOUND.

STEP 2    VARIABLE PODS ENTERED          R SQUARE = 0.75624706       C(P) =   481.99444485

                                  DF          SUM OF SQUARES        MEAN SQUARE             F       PROB>F

                 REGRESSION        2       233580.47625668    116790.23812834         767.87       0.0001
                 ERROR           495        75287.46860756       152.09589618
                 TOTAL           497       308867.94486423

                                   B VALUE        STD ERROR         TYPE II SS              F       PROB>F

                 INTERCEPT      0.06085106
                 TDM            0.38679449       0.01420519    112767.58189089         741.42       0.0001
                 PODS           0.41974341       0.04595779     12687.23808646          83.42       0.0001
---------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  2 VARIABLE MODEL FOUND.

STEP 3    VARIABLE MKWT ENTERED          R SQUARE = 0.79758279       C(P) =   318.82404819

                                  DF          SUM OF SQUARES        MEAN SQUARE             F       PROB>F

                 REGRESSION        3       246347.75754733     82115.91918244         648.83       0.0001
                 ERROR           494        62520.18731690       126.55908364
                 TOTAL           497       308867.94486423

                                   B VALUE        STD ERROR         TYPE II SS              F       PROB>F

                 INTERCEPT    -16.63728389
                 TDM            0.30057758       0.01554324     47328.54147694         373.96       0.0001
                 PODS           0.77397921       0.05478484     25259.87303865         199.59       0.0001
                 MKWT           0.01855067       0.00184696     12767.28129065         100.88       0.0001
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THE ABOVE MODEL IS THE BEST  3 VARIABLE MODEL FOUND.
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                                     MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD

STEP 4    VARIABLE SEEDSPOD ENTERED        R SQUARE = 0.84829371       C(P) =    118.19201722

                                            DF             SUM OF SQUARES          MEAN SQUARE              F       PROB>F

                   REGRESSION                4          262010.73463263       65502.68365816         689.18       0.0001
                   ERROR                   493           46857.21023161          95.04505118
                   TOTAL                   497          308867.94486423

                                                B VALUE          STD ERROR          TYPE II SS              F       PROB>F

                   INTERCEPT          -50.75744406
                   TDM                  0.23859192         0.01430907      26425.19227528         278.03       0.0001
                   PODS                 0.99061112         0.05038640      36737.46719236         386.53       0.0001
                   MKWT                 0.02935949         0.00180853      25048.16720981         263.54       0.0001
                   SEEDSPOD             9.71068317         0.75644505      15662.97708529         164.80       0.0001
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THE ABOVE MODEL IS THE BEST  4 VARIABLE MODEL FOUND.

STEP 5    VARIABLE FLOWER ENTERED          R SQUARE = 0.85310868       C(P) =    100.95224796

                                            DF             SUM OF SQUARES          MEAN SQUARE              F       PROB>F

                   REGRESSION                5          263497.92332454       52699.58466491         571.48       0.0001
                   ERROR                   492           45370.02153970          92.21549093
                   TOTAL                   497          308867.94486423

                                                B VALUE          STD ERROR          TYPE II SS              F       PROB>F

                   INTERCEPT          -38.08621987
                   TDM                  0.24462198         0.01417422      27466.05664134         297.85       0.0001
                   PODS                 0.98703681         0.04963870      36461.10796301         395.39       0.0001
                   FLOWER              -0.43377711         0.10801536       1487.18869191          16.13       0.0001
                   MKWT                 0.02879717         0.00178690      23949.91023575         259.72       0.0001
                   SEEDSPOD             9.67158594         0.74516361      15534.45405133         168.46       0.0001
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THE ABOVE MODEL IS THE BEST  5 VARIABLE MODEL FOUND.

STEP 6    VARIABLE STALKS ENTERED          R SQUARE = 0.85716528       C(P) =     86.74277252

                                            DF             SUM OF SQUARES          MEAN SQUARE              F       PROB>F

                   REGRESSION                6          264750.87746569       44125.14624428         491.09       0.0001
                   ERROR                   491           44117.06739855          89.85146110
                   TOTAL                   497          308867.94486423

                                                B VALUE          STD ERROR          TYPE II SS              F       PROB>F

                   INTERCEPT          -35.48103299
                   TDM                  0.25235833         0.01414391      28603.65660390         318.34       0.0001
                   PODS                 1.02882414         0.05025987      37649.97358405         419.02       0.0001
                   FLOWER              -0.42948605         0.10662803       1457.74143444          16.22       0.0001
                   MKWT                 0.02930492         0.00176908      24655.40344448         274.40       0.0001
                   SEEDSPOD             8.93663274         0.76142596      12377.06313797         137.75       0.0001
                   STALKS              -0.74214651         0.19873970       1252.95414115          13.94       0.0002
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                              MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD
THE ABOVE MODEL IS THE BEST  6 VARIABLE MODEL FOUND.

STEP 7    VARIABLE EMERG ENTERED          R SQUARE = 0.86018558        C(P) =     76.67416671

                                DF          SUM OF SQUARES         MEAN SQUARE             F       PROB>F

                REGRESSION       7       265683.75217168      37954.82173881        430.66       0.0001
                ERROR          490        43184.19269255         88.13100550
                TOTAL          497       308867.94486423

                                 B VALUE         STD ERROR         TYPE II SS             F       PROB>F

                INTERCEPT     -28.07142445
                TDM             0.25454655        0.01402398     29034.92065456        329.45       0.0001
                PODS            0.99150779        0.05108072     33205.26084650        376.77       0.0001
                FLOWER         -0.47238234        0.10642215      1736.40886671         19.70       0.0001
                MKWT            0.02918901        0.00175242     24450.63066404        277.44       0.0001
                SEEDSPOD        9.06164661        0.75507924     12692.81380914        144.02       0.0001
                STALKS         -0.85929322        0.20009413      1625.33470041         18.44       0.0001
                EMERG          -0.14961526        0.04598631       932.87470599         10.59       0.0012
---------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  7 VARIABLE MODEL FOUND.

STEP 8    VARIABLE PPNODE ENTERED         R SQUARE = 0.86255931        C(P) =     69.18913609

                                DF          SUM OF SQUARES         MEAN SQUARE             F       PROB>F

                REGRESSION       8       266416.92262113      33302.11532764        383.61       0.0001
                ERROR          489        42451.02224310         86.81190643
                TOTAL          497       308867.94486423

                                 B VALUE         STD ERROR         TYPE II SS             F       PROB>F

                INTERCEPT     -36.34506115
                TDM             0.26485371        0.01436341     29517.28646993        340.01       0.0001
                PODS            0.93104114        0.05480059     25058.00658364        288.65       0.0001
                FLOWER         -0.47051845        0.10562466      1722.66963595         19.84       0.0001
                MKWT            0.02937472        0.00174043     24729.37178743        284.86       0.0001
                SEEDSPOD        9.33895660        0.75545785     13266.47470800        152.82       0.0001
                STALKS         -0.72259611        0.20408563      1088.29256731         12.54       0.0004
                PPNODE          5.28150243        1.81737544       733.17044945          8.45       0.0038
                EMERG          -0.15924122        0.04576090      1051.23823768         12.11       0.0005
---------------------------------------------------------------------------------------------------------
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                                     MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD


STEP 1    VARIABLE PODS ENTERED            R SQUARE = 0.39428457       C(P) =   777.78285053

                                       DF             SUM OF SQUARES         MEAN SQUARE             F     PROB>F

                   REGRESSION           1            122661.30867833     122661.30867833        323.52     0.0001
                   ERROR              497            188437.11974359        379.14913429
                   TOTAL              498            311098.42842192

                                         B VALUE           STD ERROR          TYPE II SS             F     PROB>F

                   INTERCEPT         20.87415930
                   PODS               1.09715907          0.06099874     122661.30867833        323.52     0.0001
-----------------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  1 VARIABLE MODEL FOUND.
STEP 2    VARIABLE MKWT ENTERED            R SQUARE = 0.64638129       C(P) =   250.05491268

                                       DF             SUM OF SQUARES         MEAN SQUARE             F     PROB>F

                   REGRESSION           2            201088.20358284     100544.10179142        453.32     0.0001
                   ERROR              496            110010.22483908        221.79480814
                   TOTAL              498            311098.42842192

                                         B VALUE           STD ERROR          TYPE II SS             F     PROB>F

                   INTERCEPT        -23.22003941
                   PODS               1.51750735          0.05173313     190842.66730163        860.45     0.0001
                   MKWT               0.03831832          0.00203774      78426.89490451        353.60     0.0001
-----------------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  2 VARIABLE MODEL FOUND.

STEP 3    VARIABLE SEEDSPOD ENTERED        R SQUARE = 0.76443025       C(P) =     4.00000000

                                       DF             SUM OF SQUARES         MEAN SQUARE             F     PROB>F

                   REGRESSION           3            237813.04888165      79271.01629388        535.43     0.0001
                   ERROR              495             73285.37954027        148.05127180
                   TOTAL              498            311098.42842192

                                         B VALUE           STD ERROR          TYPE II SS             F     PROB>F

                   INTERCEPT        -70.17329154
                   PODS               1.60544468          0.04263396     209938.16518150       1418.01     0.0001
                   SEEDSPOD          13.95746413          0.88620175      36724.84529881        248.05     0.0001
                   MKWT               0.04795920          0.00177383     108225.52169299        731.00     0.0001
-----------------------------------------------------------------------------------------------------------------

THE ABOVE MODEL IS THE BEST  3 VARIABLE MODEL FOUND.
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                                     MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE YIELD


STEP 1    VARIABLE PODS ENTERED            R SQUARE = 0.33894401       C(P) =   538.01637467

                                       DF             SUM OF SQUARES         MEAN SQUARE             F     PROB>F

                   REGRESSION           1             23015.70212248      23015.70212248        251.75     0.0001
                   ERROR              491             44888.43982648         91.42248437
                   TOTAL              492             67904.14194897

                                         B VALUE           STD ERROR          TYPE II SS             F     PROB>F

                   INTERCEPT          8.96333624
                   PODS               0.77388096          0.04877402      23015.70212248        251.75     0.0001
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THE ABOVE MODEL IS THE BEST  1 VARIABLE MODEL FOUND.

STEP 2    VARIABLE MKWT ENTERED            R SQUARE = 0.57157329       C(P) =   178.60360484

                                       DF             SUM OF SQUARES         MEAN SQUARE             F     PROB>F

                   REGRESSION           2             38812.19356216      19406.09678108        326.86     0.0001
                   ERROR              490             29091.94838681         59.37132324
                   TOTAL              492             67904.14194897

                                         B VALUE           STD ERROR          TYPE II SS             F     PROB>F

                   INTERCEPT         -8.49553273
                   PODS               1.06528350          0.04317473      36144.96774760        608.80     0.0001
                   MKWT               0.02194226          0.00134521      15796.49143967        266.06     0.0001
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THE ABOVE MODEL IS THE BEST  2 VARIABLE MODEL FOUND.

STEP 3    VARIABLE SEEDSPOD ENTERED        R SQUARE = 0.68524710       C(P) =     4.00000000

                                       DF             SUM OF SQUARES         MEAN SQUARE             F     PROB>F

                   REGRESSION           3             46531.11653619      15510.37217873        354.87     0.0001
                   ERROR              489             21373.02541278         43.70761843
                   TOTAL              492             67904.14194897

                                         B VALUE           STD ERROR          TYPE II SS             F     PROB>F

                   INTERCEPT        -27.23522770
                   PODS               1.02998176          0.03713929      33616.22849512        769.12     0.0001
                   SEEDSPOD           6.99247667          0.52617625       7718.92297403        176.60     0.0001
                   MKWT               0.02399278          0.00116446      18555.21733717        424.53     0.0001
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THE ABOVE MODEL IS THE BEST  3 VARIABLE MODEL FOUND.
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APPENDIX F. PLOT DENSITY RAW DATA

OBS	FAMILY	TYPE	REP	TDM	YIELD	HI	TREAT
1	1	1	1	295	105.2	35.7	1
2	1	2	1	280	95.7	34.2	11
3	1	3	1	330	130.7	39.6	21
4	1	4	1	220	112.5	51.1	31
5	1	5	1	255	95.8	37.6	41
6	2	1	1	300	64.5	21.5	2
7	2	2	1	280	96.3	34.4	12
8	2	3	1	390	208.1	53.4	22
9	2	4	1	330	163.2	49.5	32
10	2	5	1	290	107.2	37	42
11	3	1	1	290	93.3	32.2	3
12	3	2	1	295	78.8	26.7	13
13	3	3	1	390	150.4	38.6	23
14	3	4	1	250	91.3	36.5	33
15	3	5	1	300	136.8	45.6	43
16	4	1	1	160	64.3	40.2	4
17	4	2	1	295	78.8	26.7	14
18	4	3	1	390	150.4	38.6	24
19	4	4	1	250	91.3	36.5	34
20	4	5	1	300	136.8	45.6	44
21	5	1	1	270	54.9	20.3	5
22	5	2	1	310	90.1	29.1	15
23	5	3	1	285	102.2	35.9	25
24	5	4	1	220	82.3	37.4	35
25	5	5	1	240	46.5	19.4	45
26	6	1	1	235	71.8	30.6	6
27	6	2	1	265	117.8	44.5	16
28	6	3	1	490	174.3	35.6	26
29	6	4	1	340	145.9	42.9	36
30	6	5	1	290	87.0	30	46
31	1	1	2	320	115.5	36.1	1
32	1	2	2	455	201.7	44.3	11
33	1	3	2	370	179.9	48.6	21
34	1	4	2	415	160.5	38.7	31
35	1	5	2	310	77.9	25.1	41
36	2	1	2	360	153.8	42.7	2
37	2	2	2	620	256.9	41.4	12
38	2	3	2	480	256.2	53.4	22
39	2	4	2	300	110.2	36.7	32
40	2	5	2	320	129.0	40.3	42
41	3	1	2	275	79.5	28.9	3
42	3	2	2	480	182.0	37.9	13
43	3	3	2	575	289.1	50.3	23
44	3	4	2	330	159.0	48.2	33
45	3	5	2	240	88.2	36.7	43
46	4	1	2	400	129.6	32.4	4
47	4	2	2	380	157.9	41.6	14
48	4	3	2	420	189.2	45	24
49	4	4	2	400	171.4	42.8	34
50	4	5	2	300	110.4	36.8	44
51	5	1	2	460	169.4	36.8	5
52	5	2	2	460	148.2	32.2	15
53	5	3	2	580	181.6	31.3	25
54	5	4	2	340	122.9	36.1	35
55	5	5	2	290	71.5	24.7	45
56	6	1	2	220	41.2	18.7	6

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OBS    FAMILY    TYPE    REP    TDM    YIELD     HI     TREAT

 57      6         2      2     310     70.1    22.6     16
 58      6         3      2     620    288.2    46.5     26
 59      6         4      2     400    119.7    29.9     36
 60      6         5      2     350     91.6    26.2     46
 61      1         1      3     180     59.7    33.2      1
 62      1         2      3     320    112.5    35.2     11
 63      1         3      3     345    161.8    46.9     21
 64      1         4      3     165     68.4    41.5     31
 65      1         5      3     245    101.8    41.6     41
 66      2         1      3     260     82.2    31.6      2
 67      2         2      3     290    129.4    44.6     12
 68      2         3      3     365    185.5    50.8     22
 69      2         4      3     260    102.6    39.5     32
 70      2         5      3     270     89.3    33.1     42
 71      3         1      3     270     82.2    30.4      3
 72      3         2      3     300    121.4    40.5     13
 73      3         3      3     325    165.4    50.9     23
 74      3         4      3     315    139.8    44.4     33
 75      3         5      3     170     60.7    35.7     43
 76      4         1      3     335     95.0    28.4      4
 77      4         2      3     250     80.8    32.3     14
 78      4         3      3     300    151.2    50.4     24
 79      4         4      3     235     93.4    39.7     34
 80      4         5      3     440    160.7    36.5     44
 81      5         1      3     280     70.1      25      5
 82      5         2      3     205     64.4    31.4     15
 83      5         3      3     320    104.9    32.8     25
 84      5         4      3     360    140.9    39.1     35
 85      5         5      3     260     70.1      27     45
 86      6         1      3     175     69.0    39.4      6
 87      6         2      3     230     76.4    33.2     16
 88      6         3      3     340    150.2    44.2     26
 89      6         4      3     270    138.8    51.4     36
 90      6         5      3     185     66.3    35.8     46
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APPENDIX G. SPACED PLANT F1 RAW DATA

OBS	REP	PLOTNBR	FAMILY	TYPE	PLANTNBR	SEEDS	PODS	HEIGHT	MATURITY	YLD	TDM	NODES	NNFP	STALKS	HI	SEEDSPOD	PPNODE	MKWT	TREAT
1	1	3	6	1	1	51	17	57	120	28.6	46	9	2	4	62.2	3	1.89	561	16
2	1	3	6	1	2	43	13	70	120	18.4	41	9	3	4	44.9	3.31	1.44	428	16
3	1	3	6	1	3	32	13	65	120	11.4	27	9	4	4	42.2	2.46	1.44	356	16
4	1	3	6	1	4	65	23	75	120	34.4	56	15	3	3	61.4	2.83	1.53	529	16
5	1	3	6	1	5	58	20	65	120	27.4	53	10	4	4	51.7	2.9	2	472	16
6	1	4	6	2	1	120	34	80	120	43.4	104	26	3	9	41.7	3.53	1.31	362	36
7	1	4	6	2	2	16	7	65	120	5.4	23	3	5	5	23.5	2.29	2.33	337	36
8	1	4	6	2	3	75	19	85	120	41.0	75	14	4	5	54.7	3.95	1.36	547	36
9	1	4	6	2	4	30	15	85	120	24.8	50	10	6	4	49.6	2	1.5	827	36
10	1	4	6	2	5	80	25	87	120	46.6	83	14	5	4	56.1	3.2	1.79	582	36
11	1	5	6	3	1	55	19	75	120	24.3	43	11	3	4	56.5	2.89	1.73	442	56
12	1	5	6	3	2	59	28	80	120	14.6	37	16	5	4	39.5	2.11	1.75	247	56
13	1	5	6	3	3	61	17	85	120	36.8	77	13	4	4	47.8	3.59	1.31	603	56
14	1	5	6	3	4	81	24	85	120	59.5	99	10	3	5	60.1	3.38	2.4	735	56
15	1	5	6	3	5	79	33	80	120	58.6	97	23	3	4	60.4	2.39	1.43	742	56
16	1	6	2	2	1	27	9	65	120	21.3	36	6	4	3	59.2	3	1.5	789	32
17	1	6	2	2	2	24	8	75	120	6.4	27	4	9	5	23.7	3	2	267	32
18	1	6	2	2	3	21	10	65	120	9.9	25	7	5	3	39.6	2.1	1.43	471	32
19	1	6	2	2	4	41	7	65	120	20.9	47	3	4	5	44.5	5.86	2.33	510	32
20	1	6	2	2	5	28	11	70	120	12.4	28	6	5	3	44.3	2.55	1.83	443	32
21	1	7	2	3	1	78	20	75	120	59.1	86	12	3	7	68.7	3.9	1.67	758	52
22	1	7	2	3	2	74	25	80	120	57.3	88	19	3	6	65.1	2.96	1.32	774	52
23	1	7	2	3	3	42	19	80	120	51.4	86	10	4	6	59.8	2.21	1.9	1224	52
24	1	7	2	3	4	37	16	70	120	35.2	46	10	3	5	76.5	2.31	1.6	951	52
25	1	7	2	3	5	65	14	75	120	54.7	74	8	4	6	73.9	4.64	1.75	842	52
26	1	8	2	1	1	37	10	60	120	15.6	46	6	4	7	33.9	3.7	1.67	422	12
27	1	8	2	1	2	19	11	75	120	13.7	35	5	8	2	39.1	1.73	2.2	721	12
28	1	8	2	1	3	15	9	70	120	6.8	25	7	3	4	27.2	1.67	1.29	453	12
29	1	8	2	1	4	91	25	90	120	63.7	106	17	4	5	60.1	3.64	1.47	700	12
30	1	8	2	1	5	53	19	80	120	32.3	64	14	4	4	50.5	2.79	1.36	609	12
31	1	9	5	1	1	31	14	105	120	6.8	50	10	8	3	13.6	2.21	1.4	219	15
32	1	9	5	1	2	32	10	105	120	7.3	56	5	8	2	13	3.2	2	228	15
33	1	9	5	1	3	47	23	90	120	8.4	42	14	7	3	20	2.04	1.64	179	15
34	1	9	5	1	4	92	36	115	120	30.0	102	20	6	4	29.4	2.56	1.8	326	15
35	1	9	5	1	5	12	5	85	120	2.2	38	5	8	4	5.79	2.4	1	183	15
36	1	10	5	3	1	113	52	100	120	34.8	84	27	4	4	41.4	2.17	1.93	308	55
37	1	10	5	3	2	88	24	95	120	26.5	56	14	5	3	47.3	3.67	1.71	301	55
38	1	10	5	3	3	89	46	95	120	23.1	64	19	5	4	36.1	1.93	2.42	260	55
39	1	10	5	3	4	200	49	100	120	59.9	118	25	4	4	50.8	4.08	1.96	299	55
40	1	10	5	3	5	135	54	100	120	49.1	98	28	3	4	50.1	2.5	1.93	364	55
41	1	11	5	2	1	137	50	80	120	44.5	90	25	2	6	49.4	2.74	2	325	35
42	1	11	5	2	2	93	36	90	120	26.5	58	20	2	5	45.7	2.58	1.8	285	35
43	1	11	5	2	3	83	25	90	120	14.9	43	15	3	3	34.7	3.32	1.67	180	35
44	1	11	5	2	4	71	33	95	120	27.6	70	22	3	4	39.4	2.15	1.5	389	35
45	1	11	5	2	5	53	19	100	120	15.2	36	11	3	3	42.2	2.79	1.73	287	35
46	1	12	3	2	1	73	25	70	120	41.6	74	12	3	5	56.2	2.92	2.08	570	33
47	1	12	3	2	2	177	40	90	120	44.4	89	22	3	4	49.9	4.42	1.82	251	33
48	1	12	3	2	3	43	16	80	120	17.4	35	9	4	3	49.7	2.69	1.78	405	33
49	1	12	3	2	4	75	31	70	120	37.6	74	13	3	7	50.8	2.42	2.38	501	33
50	1	12	3	2	5	50	15	65	120	20.8	38	5	3	2	54.7	3.33	3	416	33
51	1	13	3	1	1	9	3	100	120	5.8	53	3	7	2	10.9	3	1	644	13
52	1	13	3	1	2	15	5	85	120	6.5	27	5	5	4	24.1	3	1	433	13
53	1	13	3	1	3	2	2	95	120	0.3	25	2	7	3	1.20	1	1	150	13
54	1	13	3	1	4	6	2	90	120	3.3	22	1	7	3	15	3	2	550	13
55	1	13	3	1	5	1	1	95	120	0.1	60	1	6	4	0.17	1	1	100	13
56	1	14	3	3	1	104	27	100	120	49.0	77	15	5	5	63.6	3.85	1.8	471	53

OBS	REP	PLOTNBR	FAMILY	TYPE	PLANTNBR	SEEDS	PODS	HEIGHT	MATURITY	YLD	TDM	NODES	NNFP	STALKS	HI	SEEDSPOD	PPNODE	MKWT	TREAT
57	1	14	3	3	2	54	27	110	120	41.1	79	15	4	2	52	2	1.8	761	53
58	1	14	3	3	3	207	32	95	120	72.2	107	11	3	4	67.5	6.47	2.91	349	53
59	1	14	3	3	4	106	29	90	120	48.0	72	9	5	3	66.7	3.66	3.22	453	53
60	1	14	3	3	5	97	30	95	120	35.5	83	14	5	4	42.8	3.23	2.14	366	53
61	1	15	1	2	1	32	16	80	120	15.9	44	9	5	4	36.1	2	1.78	497	31
62	1	15	1	2	2	19	8	70	120	9.9	27	6	5	4	36.7	2.38	1.33	521	31
63	1	15	1	2	3	22	5	70	120	10.9	27	4	5	4	40.4	4.4	1.25	495	31
64	1	15	1	2	4	33	8	65	120	17.0	36	4	6	4	47.2	4.13	2	515	31
65	1	15	1	2	5	27	6	65	120	12.2	22	3	4	3	55.5	4.5	2	452	31
66	1	16	1	3	1	14	9	105	120	6.2	56	8	4	4	11.1	1.56	1.13	443	51
67	1	16	1	3	2	16	8	105	120	4.4	26	7	6	2	16.9	2	1.14	275	51
68	1	16	1	3	3	34	15	100	120	14.7	35	9	5	1	42	2.27	1.67	432	51
69	1	16	1	3	4	98	62	100	120	49.4	112	32	3	4	44.1	1.58	1.94	504	51
70	1	16	1	3	5	92	33	115	120	39.3	85	17	5	3	46.2	2.79	1.94	427	51
71	1	17	1	1	1	73	29	100	120	34.4	85	19	4	4	40.5	2.52	1.53	471	11
72	1	17	1	1	2	75	30	85	120	39.0	81	13	7	4	48.1	2.5	2.31	520	11
73	1	17	1	1	3	119	44	100	120	30.0	92	20	8	4	32.6	2.7	2.2	252	11
74	1	17	1	1	4	104	36	105	120	40.6	92	18	5	4	44.1	2.89	2	390	11
75	1	17	1	1	5	60	17	90	120	25.7	48	8	7	4	53.5	3.53	2.13	428	11
76	1	18	4	3	1	64	31	100	120	46.0	90	20	2	4	51.1	2.06	1.55	719	54
77	1	18	4	3	2	61	20	100	120	19.5	85	15	3	5	22.9	3.05	1.33	320	54
78	1	18	4	3	3	47	16	100	120	19.9	50	12	4	3	39.8	2.94	1.33	423	54
79	1	18	4	3	4	68	19	100	120	47.7	74	10	2	2	64.5	3.58	1.9	701	54
80	1	18	4	3	5	49	15	90	120	32.3	61	10	2	5	53	3.27	1.5	659	54
81	1	19	4	2	1	29	11	85	120	18.6	45	9	4	3	41.3	2.64	1.22	641	34
82	1	19	4	2	2	34	9	95	120	26.2	48	6	4	2	54.6	3.78	1.5	771	34
83	1	19	4	2	3	56	16	95	120	34.9	78	10	3	4	44.7	3.5	1.6	623	34
84	1	19	4	2	4	33	11	90	120	17.6	41	9	3	3	42.9	3	1.22	533	34
85	1	19	4	2	5	39	18	95	120	31.6	67	13	5	3	47.2	2.17	1.38	810	34
86	1	20	4	1	1	70	20	115	120	28.0	77	12	8	4	36.4	3.5	1.67	400	14
87	1	20	4	1	2	17	8	100	120	6.3	48	5	7	4	13.1	2.13	1.6	371	14
88	1	20	4	1	3	20	27	95	120	2.0	40	8	4	1	5.00	.741	3.38	100	14
89	1	20	4	1	4	1	1	75	120	0.1	20	1	5	2	0.50	1	1	100	14
90	1	20	4	1	5	1	1	85	120	0.1	28	1	5	3	0.36	1	1	100	14
91	2	3	1	1	1	41	16	95	120	13.4	32	13	6	3	41.9	2.56	1.23	327	11
92	2	3	1	1	2	50	15	97	120	19.3	40	10	4	2	48.2	3.33	1.5	386	11
93	2	3	1	1	3	27	11	105	120	16.7	45	4	9	2	37.1	2.45	2.75	619	11
94	2	3	1	1	4	31	8	105	120	4.5	26	5	7	2	17.3	3.88	1.6	145	11
95	2	3	1	1	5	89	18	100	120	17.7	50	11	6	3	35.4	4.94	1.64	199	11
96	2	4	1	2	1	33	15	75	120	10.4	35	6	8	6	29.7	2.2	2.5	315	31
97	2	4	1	2	2	19	6	60	120	11.4	21	5	5	4	54.3	3.17	1.2	600	31
98	2	4	1	2	3	16	5	65	120	8.3	18	4	5	3	46.1	3.2	1.25	519	31
99	2	4	1	2	4	14	6	65	120	8.7	19	4	4	3	45.8	2.33	1.5	621	31
100	2	4	1	2	5	47	15	75	120	23.1	38	9	5	4	60.8	3.13	1.67	491	31
101	2	5	1	3	1	66	26	75	120	25.8	50	14	7	5	51.6	2.54	1.86	391	51
102	2	5	1	3	2	52	23	90	120	19.4	40	14	5	3	48.5	2.26	1.64	373	51
103	2	5	1	3	3	42	19	90	120	19.6	33	7	5	2	59.4	2.21	2.71	467	51
104	2	5	1	3	4	57	23	85	120	26.8	47	13	4	4	57	2.48	1.77	470	51
105	2	5	1	3	5	103	33	105	120	62.7	110	21	6	6	57	3.12	1.57	609	51
106	2	6	4	3	1	47	20	110	120	10.3	45	14	4	3	22.9	2.35	1.43	219	54
107	2	6	4	3	2	35	17	105	120	16.7	51	10	3	2	32.7	2.06	1.7	477	54
108	2	6	4	3	3	27	12	90	120	12.9	32	9	5	2	40.3	2.25	1.33	478	54
109	2	6	4	3	4	26	12	90	120	13.2	33	8	4	2	40	2.17	1.5	508	54
110	2	6	4	3	5	16	7	105	120	6.7	22	5	6	2	30.5	2.29	1.4	419	54
111	2	7	4	1	1	27	9	100	120	7.2	24	7	4	2	30	3	1.29	267	14
112	2	7	4	1	2	121	42	115	120	40.1	92	21	3	3	43.6	2.88	2	331	14

OBS	REP	PLOTNBR	FAMILY	TYPE	PLANTNBR	SEEDS	PODS	HEIGHT	MATURITY	YLD	TDM	NODES	NNFP	STALKS	HI	SEEDSPOD	PPNODE	MKWT	TREAT
113	2	7	4	1	3	9	5	95	120	4.0	17	4	5	2	23.5	1.8	1.25	444	14
114	2	7	4	1	4	102	30	110	120	36.8	72	13	7	3	51.1	3.4	2.31	361	14
115	2	7	4	1	5	2	3	110	120	0.4	14	3	5	1	2.86	.667	1	200	14
116	2	8	4	2	1	56	17	80	120	31.4	57	11	3	3	55.1	3.29	1.55	561	34
117	2	8	4	2	2	38	14	100	120	26.4	50	11	3	2	52.8	2.71	1.27	695	34
118	2	8	4	2	3	17	6	90	120	9.5	20	6	4	1	47.5	2.83	1	559	34
119	2	8	4	2	4	52	17	95	120	33.6	70	12	2	3	48	3.06	1.42	646	34
120	2	8	4	2	5	34	12	90	120	14.1	36	10	3	4	39.2	2.83	1.2	415	34
121	2	9	2	2	1	44	13	55	120	34.0	51	11	3	5	66.7	3.38	1.18	773	32
122	2	9	2	2	2	28	8	65	120	15.7	25	6	4	3	62.8	3.5	1.33	561	32
123	2	9	2	2	3	28	9	70	120	12.9	28	7	4	4	46.1	3.11	1.29	461	32
124	2	9	2	2	4	75	10	70	120	10.2	22	8	4	4	46.4	7.5	1.25	136	32
125	2	9	2	2	5	20	6	70	120	11.2	20	4	5	2	56	3.33	1.5	560	32
126	2	10	2	3	1	46	14	95	120	26.2	45	9	4	2	58.2	3.29	1.56	570	52
127	2	10	2	3	2	68	23	80	120	28.1	58	13	4	4	48.4	2.96	1.77	413	52
128	2	10	2	3	3	46	15	85	120	46.3	72	11	2	3	64.3	3.07	1.36	1007	52
129	2	10	2	3	4	58	24	100	120	44.1	78	17	4	4	56.5	2.42	1.41	760	52
130	2	10	2	3	5	32	10	70	120	16.2	38	8	2	3	42.6	3.2	1.25	506	52
131	2	11	2	1	1	77	25	70	120	55.5	80	14	2	5	69.4	3.08	1.79	721	12
132	2	11	2	1	2	44	16	75	120	33.5	57	9	4	5	58.8	2.75	1.78	761	12
133	2	11	2	1	3	47	14	85	120	31.5	50	8	4	4	63	3.36	1.75	670	12
134	2	11	2	1	4	22	12	90	120	29.2	56	8	3	4	52.1	1.83	1.5	1327	12
135	2	11	2	1	5	72	18	85	120	42.0	61	10	4	4	68.9	4	1.8	583	12
136	2	12	3	3	1	94	29	85	120	48.7	78	14	4	3	62.4	3.24	2.07	518	53
137	2	12	3	3	2	102	33	100	120	63.0	97	16	4	3	64.9	3.09	2.06	618	53
138	2	12	3	3	3	24	16	100	120	17.4	35	7	3	2	49.7	1.5	2.29	725	53
139	2	12	3	3	4	178	33	100	120	54.0	92	13	4	2	58.7	5.39	2.54	303	53
140	2	12	3	3	5	94	30	100	120	49.1	76	12	5	2	64.6	3.13	2.5	522	53
141	2	13	3	2	1	76	25	75	120	14.8	29	15	2	3	51	3.04	1.67	195	33
142	2	13	3	2	2	25	12	75	120	3.8	12	8	3	2	31.7	2.08	1.5	152	33
143	2	13	3	2	3	24	9	80	120	6.7	10	5	4	1	67	2.67	1.8	279	33
144	2	13	3	2	4	59	14	80	120	16.6	32	6	3	3	51.9	4.21	2.33	281	33
145	2	13	3	2	5	35	14	75	120	16.8	25	6	5	2	67.2	2.5	2.33	480	33
146	2	14	3	1	1	55	24	100	120	17.1	45	7	8	2	38	2.29	3.43	311	13
147	2	14	3	1	2	54	18	100	120	6.2	29	10	6	3	21.4	3	1.8	115	13
148	2	14	3	1	3	44	18	105	120	22.5	47	11	5	2	47.9	2.44	1.64	511	13
149	2	14	3	1	4	76	26	105	120	35.2	67	15	6	3	52.5	2.92	1.73	463	13
150	2	14	3	1	5	39	22	90	120	21.0	48	10	7	3	43.8	1.77	2.2	538	13
151	2	15	6	1	1	40	15	60	120	13.4	25	8	2	2	53.6	2.67	1.88	335	16
152	2	15	6	1	2	46	18	70	120	14.8	30	10	4	3	49.3	2.56	1.8	322	16
153	2	15	6	1	3	38	10	80	120	11.2	25	6	3	3	44.8	3.8	1.67	295	16
154	2	15	6	1	4	50	16	65	120	11.9	34	9	4	3	35	3.13	1.78	238	16
155	2	15	6	1	5	57	15	80	120	15.9	36	10	2	3	44.2	3.8	1.5	279	16
156	2	16	6	2	1	23	11	100	120	18.5	32	8	4	2	57.8	2.09	1.38	804	36
157	2	16	6	2	2	37	16	85	120	19.9	34	12	6	3	58.5	2.31	1.33	538	36
158	2	16	6	2	3	23	10	85	120	15.5	31	7	7	3	50	2.3	1.43	674	36
159	2	16	6	2	4	16	5	80	120	11.4	15	3	3	1	76	3.2	1.67	712	36
160	2	16	6	2	5	53	19	85	120	47.6	72	19	2	6	66.1	2.79	1	898	36
161	2	17	6	3	1	46	17	80	120	18.8	36	7	4	3	52.2	2.71	2.43	409	56
162	2	17	6	3	2	76	20	80	120	57.0	92	10	3	5	62	3.8	2	750	56
163	2	17	6	3	3	29	9	90	120	16.4	30	5	3	2	54.7	3.22	1.8	566	56
164	2	17	6	3	4	58	21	75	120	18.3	50	16	6	4	36.6	2.76	1.31	316	56
165	2	17	6	3	5	54	13	60	120	16.4	32	7	4	4	51.2	4.15	1.86	304	56
166	2	18	5	3	1	23	14	90	120	5.2	23	9	5	2	22.6	1.64	1.56	226	55
167	2	18	5	3	2	62	18	100	120	17.2	41	11	4	3	42	3.44	1.64	277	55
168	2	18	5	3	3	52	22	100	120	16.9	35	10	3	3	48.3	2.36	2.2	325	55

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OBS REP PLOTNBR FAMILY TYPE PLANTNBR SEEDS PODS HEIGHT MATURITY YLD  TDM NODES NNFP STALKS   HI SEEDSPOD PPNODE MKWT TREAT

169  2    18      5     3      4      44    14   105      120    14.0 31    8     4     1    45.2   3.14    1.75  318   55
170  2    18      5     3      5      54    17   100      120     9.8 44   12     3     3    22.3   3.18    1.42  181   55
171  2    19      5     1      1      73    25   105      120    20.1 66    8     7     2    30.5   2.92    3.13  275   15
172  2    19      5     1      2      90    37   115      120    15.0 83   20     5     4    18.1   2.43    1.85  167   15
173  2    19      5     1      3      65    22    95      120    17.7 53   12     8     3    33.4   2.95    1.83  272   15
174  2    19      5     1      4      19     8    90      120     5.9 32    4     8     2    18.4   2.38       2  311   15
175  2    19      5     1      5      36    10   100      120     7.2 32    5     7     2    22.5    3.6       2  200   15
176  2    20      5     2      1      35    14   100      120     8.9 34   10     5     3    26.2    2.5     1.4  254   35
177  2    20      5     2      2      33    16   100      120     7.8 39   12     4     4      20   2.06    1.33  236   35
178  2    20      5     2      3      43    20   110      120    15.4 44    9     4     3      35   2.15    2.22  358   35
179  2    20      5     2      4      34    15   100      120     8.6 43    7     4     4      20   2.27    2.14  253   35
180  2    20      5     2      5      23     9    90      120     5.5 26    8     3     3    21.2   2.56    1.13  239   35
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