THE UNIVERSITY OF MANITOBA

AN EVALUATION OF SEED YIELD, PROTEIN CONTENT AND OTHER AGRONOMIC CHARACTERS OF FABABEANS (*VICIA FABA* L.)

by

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A B S T R A C T

Fababeans are a new crop for Canada. A preliminary investigation in 1970 indicated the high potential of this protein crop and initiated the present study in 1971. Over a 2 year period, several varieties of fababeans were tested on 31 locations over 8 provinces for seed yield, protein content and other agronomic characters. It was found that the seed yield of fababeans was similar to the wheat check on most locations; the wheat check outyielded the fababeans under extreme dry conditions. The average highest yield of fababeans (max. yield at each location) was 40.6 qu/ha or 3614 lbs/acre. On a varietal basis, Erfordia, Strubes, Pavane, Ackerperle and Diane performed similarly, while Maris Bead showed overall lowest seed yields.

The average protein content was found to be 29 and 17 percent for fababeans and wheat respectively. Thus on a protein yield basis, fababeans did outyield the wheat check by 70 percent. Fababeans were found to have two and a half times the lysine content of wheat but only half of its methionine content.

Other agronomic characters were found to be satisfactory; yield losses due to shattering of seeds may however become a problem.

A survey on 35 accession lines indicated that varieties originating from Europe seem to be superior to those of exotic origin. The survey also indicated favorable genetic variability with respect to

maturity, shattering-resistance and seed size, which might be of value in a breeding program.

In spacing and seed rate experiments, highest seed yields were obtained at close spacings of 15 cm and seed rates of 160 to 180 kg/ha.

The crop was attacked frequently by thrips in 1971 and at some locations by Caragana blister beetles in 1972. Minor damage occurred. Outbreak of *Ascochyta fabae*, a disease considered to be of great potential, was confined to two exotic lines at Winnipeg and occurred sporadically in the East.

> "Vicia fabae, or horsebean, cultivar
> from the old world for the edible
> beans (which are not much fancied
> in this country, where we have better)".
>
> A. GRAY, in LESSONS IN BOTANY, 1857.

INTRODUCTION

Western Canadian agriculture is continually searching for new crops in order to further diversify production. Prairie producers are frequently faced with major cereal surpluses and are forced to rely on production calamities elsewhere to create atypical markets.

In contrast to cereal surpluses Canada has never, in recent years, supplied the domestic demand for vegetable proteins. The short growing season in Western Canada prevents economic production of soybeans. Rapeseed protein has been plaqued with toxicity factors, the vagaries of the vegetable oil markets and more recently insect and disease problems. Field peas, the only other protein supplier of considerable acreage are low yielding and somewhat difficult to handle.

Fababeans (Vicia faba L.) are erect growing legumes which may have potential in this area. They are similar to wheat in maturity, high yielding and readily handled with conventional cereal equipment. Fababeans may be a valuable cash crop which would fit well into cereal rotations. It requires little or no nitrogen application and in fact may have beneficial effect on subsequent crops. In mixed farming areas they could substitute for other more expensive protein supplements in the feed rations of all classes of livestock.

Fababeans are grown in all European countries, in the Mediterranean areas, North Africa and Asia. In Europe they are used mainly for livestock, while in other parts of the world they are also used for human consumption. The market volume of fababeans is not very substantial, but Britain does export to other European countries.

Fababeans have been grown in the Maritimes to a limited extend; they are also familiar to some Prairie farmers of European origin, but have never become established here. A preliminary study in this Department in 1970 indicated the potential of this crop and promoted further investigation.

The present study evaluates fababeans under Prairie conditions in terms of their adaptation, yield potential and quality. Studies were conducted to determine the optimum rates of seeding, row spacing, swathing date and inoculation procedure. Varieties collected from around the world were observed and evaluated for their use in a breeding program.

The study also involved a more comprehensive literature review than usual in order to compile information that may be of value at the introductory stage of a new crop.

1. REVIEW OF LITERATURE

1.1 Origin and distribution

Origin. The centers of origin of *Vicia faba* were the Middle East and North Africa. It is assumed that the species *Vicia faba* is phylogenetically younger and more advanced than the species *V. cracca*, as exemplified by a shift towards autogamy, decrease in the total chromosome length and changes in habitat pattern. This evolutionary process may have happened in the younger Tertiary, when due to the decline of the Tethys, large territories in the Mediterranean and Oriental region became newly colonized, (Hanelt & Mettin,1970).

It is believed, that fababeans were selected in the early history of agriculture, because of their erect stems and easily threshed pods. Today, no wild forms of *Vicia faba* are known, (Bond, 1969; Hanelt and Mettin, 1970).

Distribution. This vigorous annual was known to ancient Greeks and Egyptians and has been under domestication for many millenia. Historically, it was the only widely used edible bean in the Old World before *Phaseolus* was introduced from America,(Janick *et al*, 1969). In an old English document dating back to the 11th century, it states that one of the duties of a revee was to sow beans in spring (Anonymous, 1969). A diversity in hardiness and day-length requirements allowed the species to spread to northern Europe, but it is grown very little in North America. According to Muratova (1937), cultivated species of *V. faba* were first introduced to the New World by Captain Hosnold in 1602, who successfully planted the crop on Elizabeth Island, off the coast of Massachusetts.

T a x o n o m y. *Vicia faba* L. belongs to the *Leguminosae* family and is one of many species in the genus. Most of the species are annual vetches some of which are utilized as forage. The closest relatives of *V. faba* are considered to be *V. narbonensis*, *V. serratifolia* and *V. pliniana*. The relationship is not that close however, as *V. faba* has a 2n number of 12 chromosomes, while *V. narbonensis*, *V. serratifolia* and *V. pliniana* have a chromosome complement of 2n = 14. The common vetch *V. sativa* has 12 chromosomes. None of the above species will cross with *V. faba* (Bond, 1969). Janick *et al* (1969) state that interspecific spontaneous outcrossings do occur with a number of wild vetches; and Bond (1970, *l.c.*) cites reports of interspecific crosses involving *Vicia faba*, conducted in the Soviet Union. The whole group is considered as a descending aneuploid series, from 2n = 14 to 2n = 12 to 2n = 10. The most conspicuous variability occurs at the 2n = 12 level, (Hanelt and Mettin, 1966). Hermann (1960) lists 35 species of *Vicia* occuring in North America; some are cultivated and others like *V. narbonensis* and V. *serratifolia* are established locally as weeds. *V. cracca*, a perennial, the bird vetch or tufted vetch, which may be one of the ancestors of *V. faba*, is widely distributed, from Newfoundland to British Columbia growing in fields, thickets and along roadsides.

The classical division of the species *V. faba* is into the three subspecies *V. faba major*, *V. faba equina* and *V. faba minor* based mainly on seed and pod characteristics. Recently, Picard (1963) crossed the 3 subspecies and used the specific behavior of certain crosses to explain these divisions. All three species are used for human and animal consumption. Traditionally, the big-seeded ssp. major is used in Europe for human consumption, while in parts of Africa and Asia the small seeded species are also used, (Bond, 1969).

The broad bean, Vicia faba major Herz. (Syn. Garden-bean, Longpod, Windsor bean) is characterized by a long pod of 15 - 20 cm containing 3 - 4 seeds. The seeds are kidney-shaped, flat and have a thousand seed weight of 900 - 1200 g. The seed colour is predominantly white or green, but black seeds do occur. This ssp. has found wide distribution and is the only one of the subspecies commonly grown as a garden vegetable. Broad beans have a shorter growing season than the smaller seeded relatives. Their stem is weak and tends to lodge, (Sjödin and Ellerström, 1968; Bond, 1969).

The horsebean, Vicia faba equina Pers. (Syn.Field bean, fababean, Silkworm bean in China) is clearly distinct from the broad bean. The thousand kernel weight ranges between 500 and 800 g, (Sjödin and Ellerström, 1968). The seeds are slightly kidney-shaped and flat. They are usually of tan colour but some black seeded varieties exist. The pods are 6 - 8 cm long and average 3 seeds. Pods are set in clusters of 2 - 3 and located on the nodes of the stem.

The tickbean, Vicia faba minor Beck. (Syn.field bean, fababean), comprises all the small-seeded varieties with a thousand kernel weight ranging from 200 - 500 g. The seeds are almost spherical. Most varieties presently grown belong into this group, (Sjödin and Ellerström, 1968; Bond, 1969).

1.2 Growth Requirements

S o i l s. Fababeans are regarded as a crop for heavier soils, due largely to their use as a break crop for cereals on these soils. Actually, they can be grown on a range of soils but with some limitations (North, 1969; Ellis, 1969; Anonymous, 1970a): Poor drainage and waterlogging are detrimental but fababeans do better under these conditions than most crops. Very light soils in drought areas and soils with a pH below 6.5 should be avoided. Jones (1963) indicates that drought in the early stage of growth is a greater hazard than waterlogging. Sebilotte (1963) found horsebeans very sensitive to a hard pan in the soil and concluded that plants with a large tape root are especially vulnerable to soil compaction. A well worked and fairly loose seedbed with a minimum of consolidation should provide the best conditions for optimum growth. Fababeans do develop a large tape root and are not considered as being very strong rooted (Anonymous, 1970a).

F e r t i l i z e r. Being legumes fababeans fix elemental nitrogen (N) through their association with Rhizobium bacteria and therefore are not dependent on applied N. It is however advisable, especially on poor soils and early plantings to apply a starter dosage of N, ranging from 15 - 50 kg/ha N, (Ellis, 1969; Anonymous, 1970b). The variability of seed yields has led many workers to the conclusion that N-fixation of the Rhizobiums may be limited and yield increases could be obtained by applying higher rates of N.

McEwen (1970a) applied up to 336 kg/ha of N (3 cwt/acre) broadcast in the seedbed along with sufficient phosphate and potassium.

At all rates (112, 224 and 336 kg/ha) germination was affected and seedling stand decreased. At the highest level, a seed yield response of 347 kg/ha was obtained. McEwen concluded based on the minor yield response that seed yield was not limited by the N-fixing capacity of the bacteria. Other workers (Anonymous, 1970a; Sjödin et al., 1972) also believed that Rhizobias reach a ceiling in their ability to fix N and that the plant could utilize more. Again, responses to N over several years were negligible on both seed yield and protein yield. A split application was then applied (Ellis, 1969; McEwen, 1970b) in order to provide a steady source of N over the growth period. Seed yield was increased significantly by an increased number of tillers and pods, (McEwen,1970b). This approach prevented the loss of seedlings but at the same time lengthened the growing period and the amount of lodging increased.

As to the other nutrients, a basic dressing of phosphorus and potassium is recommended, (Ellis, 1969; Anonymous, 1970b). There are indications that potassium is sometimes limiting (Houg, 1960; Anonymous, 1970a) and should be given more attention. Also, placement of potassium is more effective than broadcasting. As already mentioned, beans should not be grown on soils with pH below 6.5. Moffatt (1967) could demonstrate increasing seed yields by application of lime up to pH 7.

There are also indications that response to microelements can be obtained. On alluvial soil, Nikolov and Peterburgskii (1967) obtained response to applied molybdenum and magnesium.

1.3 Seeding Operation

D a t e a n d D e p t h s o f S e e d i n g. Several reports indicate that fababeans should be planted as early as possible, before cereal planting begins. Yields decrease significantly with delayed plantings and the risk of pest and disease losses is higher and harvesting will be delayed, (Derenne, 1965; Robinson, 1968; North,1969; Anonymous, 1970b). At early plantings in cold and damp soil, a seed dressing with thiram or captan is advisable, despite the very sturdy seedlings, (Anonymous, 1970b). Although no specific data are available as to the frost tolerance of fababeans in the seedling stage, it is generally believed that they can withstand temperatures below 0^{0} C. Robinson (1968) reports injuries on fababeans at -3.3^{0} C (26^{0} F), but the damage was less severe than that on barley. He also gives data of a trial planted May 3 at Rosemount/Minnesota, which yielded 1646 kg/ha as compared to a planting on May 23 with a seed yield of 658 kg/ha. Similar results were obtained in Nova Scotia (Hough, 1972) on field scale trials; two plantings in June resulted in a complete loss.

As to depth of planting, there is evidence that fababeans are in most cases planted too shallow rather than too deep. North (1969) mentions that at planting depth of 30 cm (12 in) seed yield was only reduced by 10 percent. Shallow plantings followed by dry periods can be held responsible for poor stands in many cases. A depth of 7 - 8 cm seems to be most favorable for adequate emergence, (Robinson, 1968; North, 1969; Anonymous 1970b). In a trial with several depths of planting, Kushnir (1969) obtained highest seed yields at 8 cm, as compared to 4 to 6 and 10 to 12 cm. The hard, dry seeds of fababeans take longer to absorb water and germinate than does seed of common beans. The time from planting to emerging varies from 8 to 22 days.

It has been common practice in the U.K. to broadcast beans and plow them under, (Anonymous, 1970b). This reduces planting operations and compaction. Moreover, it allows discing, harrowing and herbicide application to the planted crop with little risk. Robinson's (1968) results indicate that this could also be feasible under North American conditions, but that it delayed ripening.

Seed Rate and Spacing. Several workers (Hodgson and Blackman, 1956; Picard and Sigwalt, 1960; Bardossy, 1968; Robinson, 1968; Kushnir, 1969; Simon, 1970a and 1970b; Anonymous, 1970a and 1970b and Sjödin et al., 1972) have reported data on seed rate and spacing experiments, but most of them are not very conclusive, (North, 1969). The fababean plant is highly adaptable and shows a plastic response to various plant densities. Hodgson and Blackman (1956) noted the highest seed yield at the highest level of density, namely 67 plants/m^2. Similar results are reported by Picard and Sigwalt (1960), with optimum densities ranging between 60 - 90 plants/m^2. The same authors also could not detect any variety x population interaction nor population x spacing interactions in their material.

In general, increasing seed rate means a decrease in branching and the number of pods per plant. But it was found that seed weight and seeds per pod showed little response to various densities. Hodgson and Blackman (1956) concluded that seed production is solely governed by the number of mature pods formed per unit area.

The recommended seed rate in Britain varies from 194 - 242 kg/ha

(160 - 200 lbs/acre), with row spacings of 18 - 35 cm (7 - 18 in), (Anonymous, 1970 a and 1970 b). There is evidence that the closer spacing gives higher yields, (Simon, 1970a and 1970b; Sjödin et al., 1972). On a 3 years average, Sjödin et al. report approximately 10 percent seed yield increase at row spacings of 14 cm as compared to 45 cm. There was also evidence that seed yield increased with seed rate of up to 240 kg/ha, with the response leveling off around 180 kg/ha.

Under the more dry conditions of the small Hungarian Plain, Bardossy (1968) tested spacings of 20, 60 and 45 + 15 cm twinrows. In drier seasons spacing had little effect on seed yield. In a wet season the twinrows with 560 000 plants/ha (approx. 240 kg/ha) outyielded other treatments.

1.4 Inoculation

Fababeans, as a legume, live in symbiosis with the bacteria *Rhizobium leguminosarum*. This symbiotic relationship supplies the crop with organic nitrogen thus making it independent of artificial nitrogen supplementation.

The rhizobias effective on fababeans are also responsible for nodulation on peas and vetches. Moffatt (1967) found no differences due to inoculation on soil which had grown beans previously. Similar results were obtained by Caldwell and Vest (1970) and Ham et al. (1971) on soybeans. In soils containing rhizobias, only 5 - 10 percent of the nodules formed could be traced back to the applied inoculum, (Caldwell and Vest, 1970).

The magnitude of nitrogen fixation by a rhizobia strain can be measured by protein content of the crop and by the seed yield, (Erdman, 1953). As a field guide, fixation may be judged by the number of nodules formed as well as by examining the nodules. Once exposed to the air, a cut surface showing reddish discolouration indicates efficient fixation. An example of a quick test is also given by Brockwell (1956) working with subterraneum clover. This crop showed red-pigmented leaves when nitrogen was deficient, i.e. nodulation not effective. The anthocianin disappeared in the presence of effective nitrogen fixers. On the assumption that the yield potential of fabebeans is limited by the capacity of the nitrogen fixing bacteria, McEwen applied high doses of nitrogen to fababean crops. The response to 336 kg of applied nitrogen was however insignificant, indicating that the Rhizobia could supply all the nitrogen the plant needed. McEwen (1970a) calculates that with an average crop the removal of N is of the magnitude of 145 - 213 kg/ha, (130 - 190 lbs/acre), plus that left behind in crop residue.

In pot trials, conducted with sterilized soils, Lapinskas (1968) obtained yield increases with inoculation from 35 - 45 percent. Response was more pronounced in the presence of P, K and Ca application.

While large applications of fertilizer had no effect on seed yield, nodule formation was affected. In the experiments by McEwen (1970a), nodulation was reduced by 50 percent on plots receiving high treatments of nitrogen. In a study by Schmidt (1955), early application of $Ca(NO_3)_2$ had a favorable effect on nodule formation. This supports the common practice of a starter application of nitrogen, (Anonymous, 1970b). Experiments by Korovin and Vorobev (1967) under controlled conditions showed that cool temperatures had little effect on nitrogen fixation. They concluded that N can be fixed and is available to the plant at all temperatures suitable for plant growth.

Besides the direct effect of nitrogen fixation, crop residues are of considerable value to the following crop. This is partly due to the nitrogen and partly attributable to the good physical conditions of the soil following fababean production. McEwen (1970a) reports good response of wheat planted after fababeans. This residual effect was also noted by Robinson (1968), who reports higher yields of corn following either fababeans or vetches than following oats.

Inoculation Procedure. The inoculum is commonly applied in powder form mixed with the seed prior to planting. There is evidence that other methods of application might be more condusive to optimum nodulation. Date (1968) found that only lime-pelleted rhizobias had a good rate of survival under dry conditions, since pelleted rhizobias are less subject to dessication. Furthermore, toxic factors in the seed coat affecting the rhizobias (Thomson, 1960) will be of less hazard to pelleted inoculum.

So far little information regarding strain specifity is available. Lapinskas (1968) tested 35 local Rumanian strains adapted to *Vicia faba*. Of these, 5 were more effective than the standard line. Working with soybeans, Caldwell and Vest (1970) found noticeable variability in the nitrogen fixation of 28 isolated strains. They found a marked strain x year and strain x variety interaction. They concluded that specific strains would be superior to commercial products, which are mixtures and suitable for several crops. Erdman (1953) lists the crops which are in the same group as fababeans and normally treated with the same inoculum. This group comprises the field and garden peas, all *Vicia ssp.* as well as *Lathyrus ssp.* and lentils, (*Lens culinaris*).

1.5 Weed Control

C u l t i v a t i o n. Traditional weed control in fababeans was by means of harrowing prior to or shortly after emergence, inter-row cultivation and howing. The effectiveness of harrowing depends on weather and soil conditions as well as growth stage of the weeds and can be exercized over a short period of time only. Inter-row cultivation and howing is more effective. To facilitate this rows have to be planted at least 30 cm apart. As Griffiths (1969) points out, these methods were neither condusive to optimum yield nor was it possible to remove weeds satisfactorily in a wet season. Today, European farmers plant as close as 12 cm and depend on chemical weed control.

H e r b i c i d e s. As Griffiths (1969) states, there has been a dramatic increase in the acreage of fababeans over the past few years which can partly be attributed to improved methods of chemical weed control. Griffiths also remarks that through the use of Simazine the fababean crop is now one of the cleanest in the rotation. Most of the information available on chemical weed control is of European origin and due to climatic differences is of limited value in North America.

Simazine is by far the most widely used and successful herbicide in Western Europe, as indicated by numerous workers (Bullen and Hughes, 1960; Elliot, 1960; Moffatt and Hill, 1960 and 1961; Griffiths, 1969; Anonymous, 1970a; Javorska, 1970; Simon, 1970a; Bond, 1972). Simazine can be applied pre or post emergence, but the seeds need depth protection and should be sown at least 7.5 cm (3 in) deep after soil consolidation. Uptake of Simazine is entirely through the roots so beans not planted deep enough will pick up the chemical and produce a characteristic black marginal scorch. If sufficient is absorbed the plant will become stunted and may die eventually. Application is advised prior or as soon after planting as possible before weeds become established.

In a series of trials over a 4 years period, Simons (1970a) reports slight yield increases due to application of Simazine as compared to inter-row cultivation. Simazine was equal to a combination of cultivation and hand howing. Good control of weeds has been achieved with as little as 0.56 kg/ha (0.5 lbs/acre) (Bullen and Hughes, 1960; Elliot, 1960; Moffatt and Hill 1960 and 1961). The recommended rate in Britain is 1.68 kg/ha of 50 percent a.i. (1.5 lbs/acre), (Griffiths, 1969; Bond, 1970). At this rate, good control of annual grasses and broad leaf weeds is achieved, but Simazine has little effect on <u>Agrostis ssp.</u>, <u>Agropyron repens</u>, <u>Avena ssp.</u>, <u>Galium aparine</u> and on many deep rooted broad leaf weeds such as thistle, (Anonymous, 1970b) The effect on wild oats is variable, depending on the depth from which they germinate, (Griffiths, 1969).

At rates of 2.24 kg/ha (2 lbs/acre) efficiency of weed control increased but was not reflected in seed yields (Bullen and Hughes, 1960 and Elliot, 1960). Yield depressions were reported by Moffatt and Hill (1961) with applications of 0.56 and 1.12 kg/ha. Bullen and Hughes studied the residual effect on the following wheat crop, but could not find anything attributable to Simazine. Dry weather was partly held responsible for the failure of sufficient weed control by Moffatt and Hill (1960 and 1961). The long persistence of Simazine gives continuous weed control, but also causes a delay in planting of the crop to follow since 6 - 7 months should elapse before new crops can be planted, (Griffiths, 1969; Anonymous, 1970a).

In North American experiments with Simazine,Robinson (1968) found Simazine at 1.12 kg/ha was equal to the control but higher rates depressed seed yields. Hough (1972) reports on field scale trials conducted in Nova Scotia, where rates of 0.8 - 1.12 kg/ha gave good weed control.

Dinoseb is the only herbicide used to any extent in post emergence weed control. It is used on light and organic soils where Simazine is not recommended. Dinoseb kills weeds by contact and for optimum results the weeds should be sprayed in the seedling stage. The crop may become scorched but normally recovers quickly, (Griffiths, 1969). Reports by Krejciv (1965), Javorska (1970), Anonymous (1970a) and Hough (1972) indicate that good results can be obtained if the crop is sprayed at a rate of 4 - 5 kg/ha when the plant height is between 5 and 15 cm. However, yield reductions have been observed (Anonymous, 1960; Javorska, 1970).

On field scale trials in Nova Scotia, Hough (1972) using 4.48 kg/ha (4 lbs/acre) achieved good weed control on 2 locations, while a third location showed no response, indicating that timing of application is critical. For this and other reasons (unpleasent handling) Bond (1972) states that most farmers in England now use Simazine.

Besides Simazine and Dinoseb, several other compounds have been used for weed control in fababeans. The information available is limited and inconclusive. References to these studies are listed below.

Compound	Time & Dosage kg/ha	Effectiveness	Reference
50% Prometryne	pre em., 2-3	better than Dinoseb	Krejciv,1965
" "	3.5	various results	Robinson,1968
Maloran (N-(4 brom-3-chlorfeyl)-N-metoxy)	pre em.3 & 4	good	Javorska,1970
Barban (Carbyn)	post em.	against wild oats	Anonymous,1970a
Monolinuron	pre em.,1.2-1.5	-	Schmidt, 1971
Linuron (Lasso)	pre em., 2.0	-	Schmidt, 1971
"	-	excellent	Hough, 1972
Methabenzthiazuron (Tribunil)	pre em., 3-4	-	Schmidt, 1971
Patoran & Lasso	-	crop injuries	Hough, 1972
EPTC (Eptam)	pre em., 3.5	crop injuries	Robinson, 1968
Chlorpropham + fenuron	1.1 + 0.3	-	Anonymous,1970b
Triallate	pre em.,1.6 a.i.	against wild oats	Anonymous,1970b

1.6 Flowering and Pollination

F l o w e r i n g. The flowers are in clusters of 6 to 8 located at the nodes of the stem. Data obtained as to the number of flowers forming mature pods vary. Rowlands (1955) found that 25 percent of the flowers set seed, while Kambal (1969a)found that in the arid subtropical climate of Egypt only 10 percent were setting seed. In his experiment abscission of open flowers and young pods took place. Abscission of flowers may also be caused by low night temperatures, (Bond 1972). Rowlands (1955) found on the average only 3 seeds per pod, indicating that only 50 percent of the ovules formed seeds. Kambal (1969a)indicates that the distal embryos are developed first, produce more Auxin and have a competitive advantage, while seeds at the proximal end are aborted more frequently. Data of Gabelmann and Williams support this theory (Kambal, 1969a l.c.). The abundancy of flowers and ovules produced together with the indeterminate flowering habit ensures an elastic response to weather conditions, pollinators and growing conditions, (Bond, 1969).

P o l l i n a t i o n. Many studies have been conducted to elucidate the pollination requirements of fababeans. In view of the variable yields obtained it was hoped that a better understanding of this aspect might help in stabilizing production. Fababeans are insect pollinated, but in the absence of insects the beans still set seed. Consequently, fababeans are frequently regarded as self-pollinating, (Anonymous, 1970a), while others (Derenne, 1964; Hanna and Lawes, 1967; Bond, 1969; Kambal, 1969a) found 30 - 60 percent outcrossing. Interestingly, the German Seeds Act lists no requirement for distance isolation