Vicia faba

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ABSTRACT

The species *Vicia faba* is an ancient crop which is well adapted to cold, wet conditions. It can be grown either for production of frozen broad beans or for dried seed, which is of high nutritional quality. There are considerable differences in the mean seed weight among genotypes of this species and to some extent the end use of the dry seed depends on seed size.

Research work in New Zealand has shown that provided disease free seed is sown, in autumn, at population of about 70 plants/m^2 and the crop is provided with water, when required, that seed yields of up to 6 t/ha can be obtained. The crop has also been evaluated as a winter greenfeed for ewes and can produce up to 4.3 t/ha of forage by late May when sown in February. A yield increase of 1.8 t/ha was obtained from a succeeding spring wheat crop.

Additional Key Words: Aphis craccivora, Ascochyta fabae, Botrytis cinerea, Uromyces vicae-faba, *harvest index, nitrogen, pests and diseases.*

INTRODUCTION

Vicia faba is an ancient crop of Mediterranean origin. Its dried seed is of high nutritional quality and contains 23 % to 34 % protein (Newton & Hill, 1983). It is used extensively in human diets in the Mediterranean region. ICARDA (1985) estimated annual per capita consumption to be 9 kg in Egypt and 12 kg in the Sudan. Virtually all Egyptians eat it every week with 34 % of rural dwellers and 73 % of city dwellers eating it seven times a week. Besides their use in human diets they can comprise an important protein supplement in rations for monogastric animals (Newton & Hill, 1983).

Claridge (1972) did not list *Vicia faba* among his miscellaneous legume crops in his book on *"Arable Farm Crops of New Zealand"*. Similarly when Newton (1980) commenced her research on the crop she could find little previous published work on the species in New Zealand. Logan (1983) suggested that from 1971 to 1981 200 to 500 ha of broad beans were grown each year. The latest statistics indicate that 75.7 ha of broad beans were grown in New Zealand in 1988 (Department of Statistics, 1989). However, they do not make it clear if those were for fresh vegetables alone or combined vegetable production with beans for processing. As dry tick are mainly grown under contract and statistics are not collected for them the areas sown to them are not readily obtainable.

Given the lack of information on the crop in Canterbury, Newton & Hill (1978), conducted a survey of Canterbury farmers growing *Vicia faba* during the 1977-78 growing season. The total area surveyed was 200 ha. They found that the average seed yield was 2.59 t/ha (range 0.07 t to 6.2 t). Few farmers inoculated their seed, which was sown at an average population of 43 plants/m^2 (range 27 to 92 plants/m^2). The mean sowing date was the last week in June but sowings ranged from 1 May to 2 October.

The most worrying feature of their survey however, was the high incidence of the seed borne disease *Ascochyta fabae*. On some farms up to 100 % of plants were infected and the minimum degree of infection found on any farm was 20.0 %. Visible infection on seeds ranged from 1 % to 55 %. Work by Newton (1980), Husain (1984) and Attiya (1985) would suggest that many of the practices followed by farmers in 1977-78 were likely to ensure poor crop yields.

AGRONOMY

Seed health: Given that the disease *Ascochyta fabae* is seed borne an effective and cheap method of disease control is to only sow seed which has been tested for the disease and to only sow seed lines that have less than a recommended level of infected seeds. Gaunt *et al.* (1978) suggested that seed with more than 0.1 % infection should not be sown. Gaunt & Liew (1981) considered that seed selection was the most cost effective control method but it should be supported by use of a fungicidal seed dressing as a cheap insurance. It was their hope that following the recommendations that *Ascochyta fabae* would cease to be a problem in Canterbury.

Sowing date: Very early work by Newton & Hill (1977) showed that considerably higher yields were obtained from autumn sown than from spring sown field beans. The maximum yield from autumn sown Maris Bead was 4.3 t/ha. In the spring sowing the maximum yield was 2.2 t/ha. Autumn sown plants commenced flowering at an earlier node and carried pods over a wider range of nodes. In a later trial (Newton & Hill, 1987) the mean yield of irrigated autumn sown plants was 5.3 t/ha. Mean yield for irrigated spring sown plants was only 2.7 t/ha. When sowing in spring was delayed to late September spring yields fell from 3.0 t to 1.4 t/ha. Similarly Husain *et al.* (1988) over two year obtained an average seed yield of 4.6 t/ha from autumn sown crops and 2.9 t/ha from spring sowings. It is therefore most important that if *Vicia faba* is to be grown that crops are sown as early as possible and it appeared that many of the farmers surveyed by Newton & Hill (1978) were reducing crop yield by late sowing.

Plant population: As with time of sowing plant population has a major effect on yield in field beans. In both spring and autumn sown Maris Bead and Daffa there was a linear increase in seed yield as population increased from 25 to 75 plants/m^2. In autumn yield increased by 2.5 g/m^2 for each extra plant. However in spring the increase was considerably less at 0.7 g/m^2 per plant. Further, the response of Daffa to increased population in spring was considerably less than that of Maris Bead. Again in their later experiments Newton & Hill (1987) obtained a linear increases in dry matter production and seed yield with increased plant population. Attiya *et al.* (1983) did not obtain increased seed production in response to population from a spring sowing of but their yields 3.1 t/ha were high for a spring sowing.

Seed bed preparation: Newton (1980) suggested that *Vicia faba* did not have a high fertility requirement. It is recommended that they be sown with maintenance levels of superphosphate. It also seems that there are usually sufficient Rhizobia present in New Zealand cropping soils to nodulate field beans without inoculation. The seed are large and Maris Bead which is regarded as a small seeded cultivar has a mean seed weight of 350 mg. Field beans do not require a fine seedbed and in common with other large seeded legumes should be sown at about 5 cm. They are also not tolerant of soil compaction and the leaving of tramlines should be considered where the crop may have to be sprayed after emergence. Simazine at 1.3 kg a.i./ha combined with a plant population of about 70 plants/m^2 seems to provide reasonable weed control.

Irrigation: *Vicia faba* is a crop that responds well to irrigation. Newton & Hill (1987) using a gravimetric method to assess crop water requirement increased the yield of autumn sown crops from 3.8 t/ha to 5.3 t/ha and spring sown field beans from 1.8 t/ha to 2.7 t/ha. Husain *et al.* (1983) applied water according to crop demand based on calculated evapotranspiration. Their results confirmed that irrigation could increase the yield of both spring and autumn sown crops by 45 %. As with the work of Newton & Hill (1987) the response to irrigation was far greater in the autumn sowings than in the spring sowings. Over two years the mean increase in seed yield was 6 kg of seed/mm of water applied in autumn and 4 kg/mm in spring. However, it is notable that even in a wet year (1983-84) Attiya (1985) increased the yield of a spring sowing from 1.8 t/ha to 2.6 t/ha. In none of the trials did irrigation bring the yield of a spring crop up to that of an unirrigated autumn crop and given the increased response to irrigation from the latter it is more economic to irrigate autumn crops.

Plant pests and diseases: The major disease of *Vicia faba* in New Zealand appears to be *Ascochyta fabae.* The main control method of the disease is prevention (as discussed above). Janson (1984) reported *Botrytis cinerea* and *Uromyces vicae-fabae* were a problem in late summer sown tick beans in mid-winter. The aphid *Aphis craccivora* has been reported to infest *Vicia faba* but is not considered to transmit subterannean clover red leaf virus (Wilson & Close, 1967, cited by Newton, 1980)

NITROGEN TRANSFER

Janson & Knight (1980) and Janson (1984) investigated the potential of *Vicia faba* to provide forage for sheep in the winter and nitrogen for a succeeding spring wheat crop. In the first season the plants were sown at the end of the first week in March. They produced 4.4 t/ha of forage which was 69 % utilised when grazed in mid August. By October the forage on offer was 6.6 t/ha but utilisation fell to 59 %. Yield of the following spring wheat crop after tick beans was 3.75 t/ha compared with 1.6 t/ha from the control (Janson & Knight, 1980). In a second trial the tick beans were sown in February and March and forage yield was reduced by disease and frost damage in winter. However, spring wheat yields were still increased after the crop was either grazed just before sowing (6.0 t/ha) or ploughed in six weeks before sowing (4.9 t/ha) compared with the control of winter fallow (4.1 t/ha).

Newton & Hill (1981) measured the amount of nitrogen in a standing *Vicia faba* crop and estimated the nitrogen harvest index. It was considerably higher than the harvest index for seed with a mean value in autumn of 58 % (seed HI 32 %) and in spring of 50 % (seed HI 25 %). Their results suggest depending on cultivar and sowing time that between 42 kg N/ha could be returned to the system following harvest of a spring crop and 112 kg N/ha following harvest of an autumn sown crop which usually produces considerably more dry matter. There have been no experiments in New Zealand which have attempted to measure the nitrogen return from a harvested *Vicia faba*

FUTURE POTENTIAL

At the present moment the potential for this crop in New Zealand appears to be limited. However, because of its ability to grow in winter on soils with a high water content it tend to compliment rather than be in opposition to crops such as peas and lupins. Because potential markets can arise at any time it is important that New Zealand continues to import and evaluate the latest cultivars. Recently Jones *et al.* (1989) evaluated a range of new winter and spring cultivars from the United Kingdom. A number produced significantly more dry matter than currently available lines and one, Banner Winter, produced the equivalent of 4.4 t/ha compared with Maris Bead at 4.1 t/ha. There is no doubt that we now have a considerable knowledge as to how to grow this crop in New Zealand, all that is needed are the markets. Perhaps we can tap the Egyptian market where the demand is high and available land which can be irrigated is finite.

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