FRUIT SETTING AND YIELD OF BEAN PLANT (VICIA FABA L.) AS AFFECTED BY SOME AGRONOMIC FACTORS

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C O N T E N T S

I N T R O D U C T I O N

Field bean is one of the most important leguminous crop grown in U.A.R. The average yield per unit area decreased during the period from 1945 to 1960 and then increased during the last decade.(1)

The U.A.R. government is pressing hard to increase the tonnage of field bean to meet the needs of the masses. This could be achieved by increasing the acreage of field bean and/or by improving the production per unit area.

The yield per unit area could be increased by growing heavy yielding varieties, improving cultural treatments or some other factors.

Flower shedding of bean is considered to be one of the most important factors affecting the yield of bean plant. Shedding percentage of flowers ranged from 62 to 81 %, Fobgy and Ibrahim (49). The yield of field bean could be increased by increasing fruit setting.

This work was designed to investigate fruit setting and yield of bean plant as affected by some agronomic factors.

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(1) Ministry of Agriculture U.A.R. Economical and Statistical Section 1968.

REVIEW OF LITERATURE

For the diversity of the work performed on horse bean plants, the literature has been reviewed under the following four headings :

A- Flowering and pod setting

B- Pod development

C- Chemical analysis

D- Yield and its components

A- Flowering and pod setting

The life growth of horse bean plants in the field could be divided into two phases, namely vegetative phase and flowering and fruiting phase. During the vegetative phase, all the metabolites synthesised by the plants are used in building vegetative parts namely roots, stem and branches and leaves. After flower induction, plants start to flower and metabolites are used mainly in the flower and fruit production. The appearance of the first flower on the plant could be used as an outward expression to the conversion of plants to flower and fruiting phase.

Ibrahim (27) and Tobgy et al (48) reported that the first flower appeared on the main stem, then on the

first branch, then on the second branch and so on. The number of days from sowing to the appearance of the first flower varied considerably among investigators. It was 29 and 50 days after sowing in early and late sowing respectively (51), 54-56 days after sowing (22), 60-70 days after sowing (48), 70 days after sowing (42), 44-59 days after sowing (17), 93 days after sowing (41) and 156 and 65 days after sowing for sowing in December and mid April respectively (11). The time from sowing to the appearance of the first flower varied considerably according to variety (41), time of sowing (51,21,47,36) and according to the year of growth (17).

The flowers are clustered in raceme inflorescences. Some nodes carry inflorescences, while others do not. The first few lowest nodes on the main stem do not carry inflorescences. The first node carrying inflorescence on the main stem was the fifth (27), the sixth (45), the fifth to sixth (22), the seventh (51,11) node. The first node carrying inflorescence ranged from 5.1 to 8.6 (41) and from 5.1 to 8.2 (17). However, the first node of the stem carrying inflorescence varied according to variety (41) as well as growth season (17). Few of the lowest nodes of the main stem do not carry inflorescences, while the

first inflorescence on the branches was the first node (27).

Horse bean plants produce their flowers in winter, during December, January, February and March in U.A.R. Plants are capable of producing flowers for a period varying in length according to varieties and time of sowing. The flowering period varied from 34 to 37 days (27), 43-54 days (17) according to the varieties and from 50 - 76 days (51), from 22 to 30 days (22) and from 42.6 to 88.6 days according to the time of sowing (36) and from 37 to 54 days (17) and 88.6 to 105.9 (36) according to the growth season. However, the duration of the flowering period became short by delaying the time of sowing (51, 22, 36). The duration of the flowering period varied from one growth season to another (17, 36).

The weekly number of flowers opened during the flowering period of horse bean plants amounted to 12-16 flowers (27, 48). The rate of flower anthesis varied during the flowering season. The number of flowers opened became low during mid and end of January (22).

Horse bean plants carry flowers in clusters in axillary raceme. The number of inflorescences carried

per plant ranges from 36 to 42 inflorescences. The inflorescences per main stem outnumbered those per first branch and those on the first branch were greater than on those of second branch and so on (48). The number of inflorescences per plant varied greatly according to variety (27). It became low by delaying the time of sowing (22)

There were 3-4 flower-buds per inflorescence (27,48). The position of the inflorescence exerted an effect on the number of flowering buds per inflorescence (27,48). The flower-buds on the main stem as well as first branch outnumbered those on others. The number of flower-buds per plant amounted to 123-158 buds according to the variety (27, 48). It became low by delaying the time of sowing (22).

The mean number of flowers per inflorescence varied from 3 to 3.5 according to varieties (27,48). The lower inflorescences carried more flowers than the upper ones (31). The number of flowers per plant varied from 83 to 111 (27,48 and from 55 to 229 (41) according to varieties. The number of flowers per plant is regulated by many factors among which varieties and time of sowing are the most important. However, early sowing gave greater number of flowers per plant than late sowing (7,22,23).

The number of pods per inflorescence amounted to 1-2 (27,48), while the number of pods per main stem ranged from 2.3 to 5.9 (51). The number of pods carried per plant varied greatly among investigators. Ibrahim (27) and Tobgy et al (48) found that plants carried 20 to 25 young pods per plant and 9 to 14 mature pods per plant according to the variety. The number of pods per plant varied from 6.5 to 11.1 (45), from 16.7 to 38.8 (41), from 2 to 45 (38), from 18 to 38 (17) and 6-30 (3) according to varieties and from 5.3 to 7.2 according to the time of sowing (36).

The fruit setting percentage is greatly affected by many factors. Rowlands (41) reported that fruit setting percentage varied from 14 to 33.2 % according to the variety. Fruit setting was greatly depressed under high temperature conditions (29). It was greater in early sowing than late one (6). In U.A.R. Hamid (22) suggested that reduction in fruit setting percentage during mid and end of January was attributed to frost. Pod setting was 18.7, 00 , 4.4, 11.4 and 20.4 % for the sowings on 18 and 27 November and 4, 11 and 18 December respectively. Mohamed (36) found that there was a gradual decrease in percentage of mature pods as seeding date was delayed.

B- Pod development

The time required for growth of horse bean plants is 4.5 to 5.0 months (34), 5 to 5.5 months (1), 140 to 147 days (17) and 131 to 134 days (48). Fruits on the main stem became mature earlier than those on first branch and those became mature earlier than those on second branch and so on (48).

The period from the beginning of flowering to the beginning of fruit setting varied from 16-18 days. The local varieties reached the maturity stage after 50-55 days from the beginning of fruit setting (48). The extent of growth of the fruit from anthesis to maturity is extremely variable. In some species the fruits enlarge relativelly little while in others they may increase in volume many thousand times. Furthermore, the period of growth is also variable, from as little as one or two weeks to as much as one to several years. In the great majority of plants, however, fruits are initiated and mature within a period of several months (13). The increase in volume associated with fruit growth is the result of cell division or cell enlargement, or both. The relative importance of these processes in the ultimate size of the fruit varies from one species to another.

Generally, cell division predominates during the initial stages of growth but overlaps the cell enlargement phase, which continues until maturation of the fruit. Although this aspect has been investigated in only a relatively small number of fruits, it is evident that many variations occur in this general scheme. Thus, in one species of tomato (Lycopersicum esculentum) Houghteling (26) found growth to be the result of cell enlargement alone while in other (L. pimpinellifolium) some cell division, accompanied by cell enlargement, occurred throughout the period of fruit growth.

C- Chemical contents

The nitrogen percentage was higher in young horse bean plants than in old ones, but phosphorus percentage did not vary with age (21).

Application of potassium sulphate to horse bean plants increased potassium concentration (25; 4) and decreased the concentration of nitrogen and phosphorus in the tissues of plants (25).

Adding calcium superphosphate to horse bean plants increased the concentration of phosphorus (15, 21, 4) as well as the concentration of nitrogen and potassium (15, 21).

D- Yield and its components

The yield of horse bean and its components are regulated by many factors among which varieties, fertilizers and time of sowing are the most important. However, the addition of potassium sulphate had no effect on the yield of horse bean (35, 32, 4).

Moes (35), Last and Nour (32), Prummel (39) and Bains (4) found that calcium superphosphate had no effect on the yield of horse bean, whereas, Boyd (6), Ballatore (5), Calzada (10), El-Sherif (15) and Hanna and Lowes (23) reported that applications of calcium superphosphate increased the yield of horse bean. Potassium sulphate as well as calcium superphosphate caused an increase in the number of flowers and seed set (23), number of pods and their average dry weight (2) and weight of 1000 seeds (25).

Weight of 100 seeds of horse bean varied from 13.7 to 190 grams (16), 43 to 131 grams (46), 40 to 190 grams (24), 41.2 to 75.9 grams (41) and from 38 to 76 grams (17) according to varieties, and from 63 to 72 grams (51), from 37.9 to 41.1 grams (32) and from 47.7 to 80.6 grams (36) according to the time of soving.