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The interference effects of weeds on the yield and yield components in different nitrogen levels in faba bean *(Vicia faba)*

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Key words: Faba bean, nitrogen, weed interference, yield, yield components.

Abstract

In order to investigate the effects of nitrogen and weed interference on the yield and yield components in the broad bean plant, an experiment was conducted in 2011 in the split plot form in the randomized complete block design with four replications in the farm of Martyr Salemi, Ahwaz. The main factor included nitrogen in three levels (20, 80 and 140 kg.he^{-1} net nitrogen) and the interference of weeds in three levels (Weeding to before the budding stage budding, weeding to flowering and complete weeding). The obtained results of the measured variance analysis of qualities showed that the nitrogen effect on the entire qualities was significant and in the case of interference of weeds in most of the studied qualities had a significant difference with each other. The results demonstrated that in the case of nitrogen the highest performance was related to the utilization of 80 kg in hectare and in case of weeding the highest yield was related to the complete weeding. But as in the most of the assessed qualities the 80 and 140 kg.he^{-1} treatments and also complete weeding and weeding till the flowering stage did not have a significant difference and with reference to the bioenvironmental issues and an economy based on the reduced use of the nitrogenous fertilizers and even reducing the labor costs, the 80 kg.he^{-1} treatment and weeding till flowering can be introduced as the most desirable treatment in the desired experiment.

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Introduction

The Fava bean plant is one of the most important dark pea plants (Fabaceae) in the world and Iran. Among the grains, in Iran, Fava bean from the viewpoint of cultivation level and the economic importance is placed after bean. In the view of the importance and nutritional value of the grains and broad bean, the production of this product on the global level and especially in the developing countries has attained an increased attention (Koochaki and Banayan Awal, 2009). Therefore, the recognition of different aspects of its statistics like morphological characteristics, physiological, resistance to pests, disease and weeds are placed on the top of the research programs Jafari *et al*., (2003). With increased population and ever-increasing demand for protein, the utilization of plant protein sources is increasing. This arable plant with possession of much protein amount is being considered as an invaluable resource (Majoon Husseini, 2008). Nitrogen is one of the main elements in the plant nutrition Salvajiuti *et al*., (2009) and due to its key role in the qualitative and quantitative plant performance improvement and also the effect of this element on the arable ecosystem, its management in the soil is considered as one of the important issues in the agriculture Sayadi *et al*., (2013). The two main aims in the production of agricultural products, is achieving the maximum performance besides maximum quality. One of the most important issues in the line with these two aims is weed competition with arable plant Hamzaei *et al*., (2007). The weeds are the plants which grow in the unwanted environment in an intermediating competitive over the limited and common resources, leading to the reduced quality and performance of arable plant Sayadi *et al*., (2013).The competition of weeds with arable plants is one of the most important factors which affect the characteristics of the plants and its impact can be possibly up to an extent that could alter the form and size of the plants in a considerable manner and affect their performance. As per the definition, competition is the desire of adjacent plants, in utilizing the light quantum, food elements, water molecules and the common and limited spaces. Thus, the competitive capability of one type *via* capacity, absorption speed and utilization of the resources is determinable (Ghamari and Ahmadvand, 2013).The intensity of weed competition with arable plant depends on the type, intensity and the weed pollution period and climatic conditions. The assessment of the different qualities of plants which are in competition, gives a better understanding of the resource limitations and its effect on the plant population is obtainable (Ghamari and Ahmadvand, 2013). Stagnari and Pisante (2011) stated that with an increased cycle length of weed presence in the farm, a decreasing trend in the pod number in shrub and bean performance was observed. Kavermasi *et al*., (2011) reported that the increased weed competition had reduced the bean height. On this basis, from the point of view that recognition and determination of the sensitive stages of an arable plant in competition with weeds can assist in the realization of the weed population effects on the arable plant, this research was conducted with an intention to investigate the effect of different interference cycles and also the weed control on Faba bean.This study is an attempt to achieve optimum Nitrogen rate for Faba bean production and yield components are determined. Effect of weed interference on yield and yield components critical to understanding the interaction of weeds. Interactive effects of nitrogen and weed interference on yield susceptibilities to these two factors.

Material and methods

Location of test implementation

The experiment was carried out on the months of November - December, 2011 in the farm of Martyr Salemi, Ahwaz town, located in north latitude 20' and 31 degrees and eastern latitude 40' and 48 degrees and height of 22.5 meter from the level of the sea in the form of split randomized complete block design with four replications. The main factor, different nitrogen quantities in three levels (20, 40 and 180 kg in hectares net nitrogen) and the secondary factor was also in three levels of weed interference (weeding

till prior to budding, weeding till flowering and complete weeding). Before execution of the experiment, in order to determine the physicochemical characteristics of the soil of this land *via* a lift the random sampling was carried out and the analysis results of this soil in tabulated in Table 1.

Table 1. Physiochemical characteristics of farm soil sample.

	Soil components percent				The absorbable elements			
Sampling depth(cm)	Clay	Silt	Sand	pH	Total nitrogen (%)	Phosphorus (ppm)	Potassium (ppm)	Soil texture
0-30	45	16	41	7.8	5.78	9.2	120.12	Loamy clay
30-60	44	15	42	8.1	3.99	7.1	91.4	Loamy clay

The land preparation operations were sequentially deep ploughing, disc, masonry trowel, and spraying fertilizer; 10 $kg.he^{-1}$ nitrogen in the form of urea which was implemented in the form of tape was on each row. The prime irrigation was on the 24th November in the form of stream and stacked. The other irrigations took place congruous with the need of the plant during the season and site usage. The weeding control was carried out by hand once in a week and based on the plot plan; there was nil utilization of any weedicide in the plan. The figure used in this experiment was bliss. The certified seeds were procured from the Dezful Agriculture Research Centre. The dimensions of each Crete were 4 x 5 and comprised of 5 rows where the distance between the rows was 60 cm and in the rows was 12 cm. The cultivation depth was considered 5 to 7 cm. The cultivation operations were manual. The final cropping with consideration of 1.5 square meters from the land surface and the sampling was performed. For measuring the qualities related to the performance and performance components (seed number in a pod, pod number in a bush, weight of 100 seeds). 10 samples were randomly collected among the samples, selected and the desired qualities in each bush were measured. Even, the weight of 100 seeds was measured with estimating the collective 100 samples and randomly selected from each Crete and their average assessment was calculated.

Data variance analysis

In order to analyse the data, the SAS software was used. The average case study qualities with utilization of Duncan Multiple Range test in the 5% probability level were compared.

Results and discussion

Weight of 100 seeds

The variance analysis results showed that the weight of 100 seeds in the different levels of nitrogen had a significant difference. By comparing the averages it was observed that the highest weight of weed (110.59 gram) with utilization of 80 kg nitrogen in hectare and the lowest (100.18 gram) with utilization of 140 kg in hectare was established. In this experiment, the increased nitrogen consumption increased the weight of hundred seeds that was due to accessibility to more nitrogen and increase of vegetative and reproductive components. From the above matter, it can be presumed that nitrogen with increased transfer of the produced assimilations *via* plant to seed, leads to the increase in seed weight. Moreover, this percept can be a designation for increased plant green surface, the permanence of leaf surface after the flowering stage and even the initiation terms. Even Ayaz *et al* (2004) evaluated the positive effect of nitrogen fertilizer on the weight increase of 100 seeds. The effect of weed elimination on the weight of 100 seeds in the 1% level was significant and highest weight of 100 seeds 109.28 was related to the complete weeding treatment and lowest weight of 100 seeds with 97.87 was related to the weeding till the budding stage. The interactive effect of nitrogen and weeding in the case of this quality was not significant. Golipour and associates in 2010, while investigating weed control in sunflower reported reduced seed weight due to the

competition with weeds which were in concurrence with the present research. Even the present results were in accordance with the results of Mehr Pouyan (2011), Eftekhari *et al* (2005) based on the effects of different treatments, the initiation of weeding period or weed interference on the weight of 100 seeds is in accordance. Due to the competition of weeds and lack of food materials allocation to the seed during the filling, the weight of 100 seeds becomes victim of changes due to the competition between the crop and the weed. Likewise, in the case of elimination period of weed interference it can be said that as the weed interference cycle length increases, due to the lengthening of the competition cycle of the weeds with arable crop, the weight of 100 seeds is subjected to impact and drops. May be the reason of this percept is due to the allocation of more photosynthetic material to the vegetative parts of the plant for more absorption of light and food materials, due to this reason lower photosynthesis is sent towards seeds and the weight of 100 seeds reduces. Likewise, Hosseini *et al* (2009) in the investigation of nitrogen level effect and weed interference time period on the performance and the performance component of corn grain reported that the reduced weight of 100 seeds was only significant in the increased weed pressure in the treatment.

Table 2. The qualities squares averages assessed in the Fava bean in the different experimental treatments.

Variation resources	Freedom degree	Weight of 100 seeds	Pods number in a Plants	Seeds number in a pod	Seed yield
R	2	40.43	0.26	0.35	4047
Na	2	365.69*	1.34*	1.13*	18132**
Ea	4	31.37	0.33	0.02	1313
W	2	315.39**	5.64**	0.80**	75824**
W x N	4	11.47^{n,s}	0.04^{n,s}	0.01^{n,s}	908^{n,s}
Eb	12	15.74	0.26	0.08	639
Cv%		3.77%	5.2%	6.3%	5.43%

* and ** sequentially are significant in the 0.01 and 0.05 levels, n,s is insignificant

Pods number in a plant

The variance analysis results showed that the qualities of the pods number in a plant were significantly influenced by the nitrogen effect and weeds in the 1% probability level. The interference effects of weeds and nitrogen upon the pods number in a plant was insignificant. The pods number in a plant in the nitrogen levels; 20 and 80 kg in hectare did not have a significant difference, but these two levels with 140 kg in hectare level had a significant difference and the 80 kg in hectare level had a highest pods number (9.92) and 140 kg had a lowest pods number in the plant (Table 3.). Basically the number of pods in a specified plant is the determination of the performance potential since the pods on one side cover the number of seeds and on the other side are the providers of photosynthetic materials needed by the seeds and is estimator of the weights. The nitrogen level can up to a certain extent lead to the production and formation of the pods. In the conditions of weeds control, the highest pod numbers were in the complete weeded bush with 10.28 and lowest was in the weeding prior to budding with 8.82. The results of this study are in concurrence with findings of Ahamdpour (2010). Raastgoo *et al* (2009) in the assessment of the interference weeds cycle effects on the performance and performance components statistics with different growing types of bean have indicated that pod numbers in a bush significantly reduces with the increased weeds interference period after cropping. Van Akar and associates (1993) introduced pod numbers in plant as one of the most important and most sensitive performance components of the seed. Also, in the pea the reduced pod number in the plant is reported to be due to the competitive effect of weeds Saxena (1996).

Seed number in pod

The variance analysis results showed that the seed number quality in the pod was significantly

influenced by the nitrogen effect in the 5% probability level and as well influenced by the weeds effect in the 1% probability level. The interactive effect of nitrogen and weed interference on the seed number in the pod was insignificant. The seed number in a pod in different nitrogen levels; 20 and 80 kg in hectare did not have a significant difference, but these two levels showed a significant difference with the 140 kg in hectare level and the highest number of seeds in the pod was in the 80 kg in hectare level equivalent to 4.65 and the lowest number of seeds in the pod was in the 140 kg in hectare level equivalent to 4.41. The increased interference cycle length led to the decrease in the number of seeds in the pod and the increased control period increased it. This was in a manner that the highest number of seeds in a pod (4.79) was related to weed control treatments and the lowest (4.20) was related to the weeding till prior to budding treatment. The reduced number of seeds in the pod was also reported by other researchers due to the competitive effect of weeds (Gamari and Ahmadvand, (2013), Agha AliKhani *et al* (2006). In the present study, the reason for the reduced number of seeds in the pod can be stated as the probable shadow casting of the weeds and in result the reduced photosynthesis followed by reduced accumulation of dry matter, leading to less material supply to seeds and the competition between the seeds for absorption of more polysynthetic matter caused the seeds to perform as a more powerful reservoir preventing the growth of seeds that had the less power to absorb the materials.

Table 3. Comparing the averages of nitrogen and weed control effect on the performance and performance component of Fava bean.

Treatment	Grain100 weight	Number of pods per plant	Grain number per plant	Grain yield (g/m2)
Nitrogem				
20 kg.ha^{-1} (N1)	102.68b	9.74ab	4.51ab	457.01b
80 kg.ha^{-1} (N2)	110.59a	9.92a	4.65a	513.05a
140 kg.ha^{-1} (N3)	100.18b	9.53b	4.41b	424.29b
weeding				
before budding(W1)	97.87b	8.82b	4.20b	362.16c
till flowering(W2)	106.30a	10.09a	4.58a	493.15b
Complete(W3)	109.28a	10.28a	4.79a	539.04a

*The averages in each column, which have at least one common letter, in the 0.05 level, do not have a significant difference with each other.

Seed yield

The variance analysis results showed that the seed yield quality was significantly influenced by nitrogen as well as weeds in the 1% probability level (Table 2.). The interference interaction of weed and nitrogen on the seed yield was insignificant and with relation to the averages showed, the highest seed yield related to 80 kg.ha^{-1} utilization of nitrogen equivalent to 513.05 gm in square metre and the lowest seed yield with 140 kg.ha^{-1} utilization of nitrogen equivalent to 4240.29 gm in square metre (Table-3). The high seed yield in the above conditions can be due to the genetic peculiarities and the nitrogen fertilizer level since the plant due to nitrogen absorption effect had better use this material in the physiological and hormonal activities and showed a better response Mazloom *et al* (2009). Lek and associates (2010) stated that the increased seed yield due to increased nitrogen consumption is *via* formation of a powerful reservoir i.e. the more seed number and source activity which relates to more leaf surface index and source activity i.e. increased leaf surface index and resistance. The increased interference cycle length, led to the decrease and increase in the control cycle length, which led to the final seed yield increase of Fava bean. This was in a manner that the highest seed yield (539.04 gm in metre square) was obtained in the complete weed control treatment and its lowest (326.16 gm in metre square) was gained in the weeding prior to budding treatment (Table 2.). The

results of the present research were in concurrence with the findings of Ahamdpour (2010). NegoJiyo *et al* (1997) also reported the reduced bean yield due to the competitive effects with weeds. The reduction in the seed yield can be related as an unfavourable effect of weeds on arable crop *via* reduction of growth resources which with reduction of yield components lead to final seed performance reduction Gamari and Ahmadvand (2013). With more increased weed interference in Fava bean or delayed weeding period, the competition was sufficiently intensified for significant reduction of seed yield and when the interference was continued till the termination of growth cycle the weed losses reached its maximum level which was compliant with the results of Mehr Pouyan (2011).

Conclusion

The nitrogen effect on the weight of 100 seeds and pod number in a plant and seed number in a pod and the seed yield had a significant effect. The weed interference on the entire case study qualities had a significant effect. With an increased interference cycle of weeds, the final seed yield reduced. The weed interference led to the decrease in the pod number in a plant and the seed number in a pod. The results are representing that the weed control in the beginning of the Fava bean growth season can be effective in the prevention of the performance reduction. Based on the results, the highest dry matter was achieved when the farm in the entire season was devoid of the weeds and when it was in competition with weeds a significant reduction was observed in its dry matter.

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