Response of different weed control periods on some growth traits and yield of field pea (*Pisum sativum* L.)

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Abstract

This experiment was laid out in the winter season of 2023 at Erbil governorate at Gerda-Rashe research center Agriculture Engineering Sciences, Salahaddin University - Erbil to study the seed yield and some growth traits of three varieties of field pea as influence by deferent weeding control periods. The experiment was laid out in Randomize Complete Block Design RCBD with three replications. Three varieties of field pea (local, Getar seed and Emma) and five weeding control periods were implemented. Results show the highest rates of leaf area, No. of pods per plant, seed yield per plant and 1000 seeds wight for Local variety, while the plant height, No. of branch and No. pods per plant for Getar variety out yielded which were 90.18cm, 4.57 and 16.46 respectively. However, the maximum rates (4.81, 171.16cm2, 23.38, 5.7, 29.99g and 31.66g) respectively of No. branch, leaf area, No. of pods per plant, No. of seeds per pod seed yield per plant and 1000 seeds weight were produced by W1 15 days after planting and plant height (74.52cm) by W_2 (30 days after planting). Finding the interaction between the varieties and weeding periods significantly affected No. of branch, No. of pods per plant, seed yield per plant and 1000 seeds weight and recorded maximum values by V_1W_1 which were (5.55, 26.55, 37.38g and 32.6g) respectively, and for leaf area and No. of seeds per pod were obtained by V_2W_1 recorded (220.1cm^2 and 5.89) respectively, while V_2W_2 gave 106.22cm for plant height. The seed yield was affected more by varieties, and the affected of weeding periods was highly significantly.

Keywords: Field pea varieties, Growth trait, Seed yield, Critical weed-free period, Competition.

Introduction

A vast genus of plants known for their high nutritional content, legumes (Leguminosae) are an essential food source for both humans and animals. The need for legumes is growing along with the world's population, which is driving up production. Field pea (Pisum sativum L.) is a significant pulse crop widely utilized in human nutrition. [1] Peas, which are considered as a significant winter vegetable in the Leguminosae family, are very susceptible to weed infestation. Unwanted plants that negatively affect the efficient use of land and water resources are known as weeds. When weed control measures are not implemented effectively, there is a decrease in crop yields. The extent of this yield reduction is influenced by the specific weed species present and the overall abundance of weeds in the area.[2]. Because of their comparatively short maturity period, vegetables are an essential component of the cropping pattern and are well adapted to a variety of agricultural systems. Because of their high yield potential, financial benefits,

ISSN 2072-3857

nutritional worth, and suitability for small-scale farming, vegetable crops are very important. The plant species known as field pea, scientifically classified as Pisum sativum var. arvense, is a member of the botanical family Fabaceae, also referred to as Leguminosae. The field pea has its origins in the Mediterranean region of Southern Europe and Western Asia[3]. Several factors influence seed and biomass yield in field pea, including cultivar, location, and environmental growth conditions. Significant variation in pea seed quality within a year suggests a considerable impact of environmental conditions, agronomic practices, and genetic factors (Kasturi Krishna and Ahlawat, 1999). Field pea genotypes exhibited significant differences in various growth parameters, including specific leaf weight (SLW), crop growth rate (CGR), relative growth rate (RGR), net assimilation rate (NAR), and absolute growth rate (AGR) at various growth stages. [4] reported 15 to 60 days after sowing critical period of weed competition in Tendril pea. Therefore, weed control during the critical period of competition is important to get highest economic returns. weed emergence before or after the critical period of competition may remove some amount of the nutrients, which deplete the availability of nutrients for the present or succeeding crop. Keeping the above view, the present experiment was conducted to find out the effect different weed control periods on nutrients uptake by crop and weeds [5]. Increased exposure to light, which is essential for photosynthesis, benefits field pea plants. This biological process involves the absorption of light energy by chlorophyll, which is subsequently converted into chemical energy [6]. It seems from the works reviewed that weeding periods and with consideration of the detrimental impact of weeds, the aim of this study was to detriment the best varieties and best weeding periods and to select the best interaction between field pea varieties and periods weeding under the prevailing conditions of the study area.

Materials and methods

The experiment on field pea was conducted during the winter season of 2023 at Gerda-Rashe research center Agriculture Engineering sciences / University of Salaheddin- Erbil, to determine the soil of experimental plot was sandy-loam in texture, slightly alkaline in reaction (pH 7.43) medium in organic matter (0.86%), total Nitrogen (0.09%) and Potassium Available (240 ppm) and Phosphor available (9.5 ppm). The experiment field was tilled once with plough and twice with rotary. Treatments consisted of weed free up to 15, 30, 45, 60 days after sowing. In addition, control treatment weedy was also included. The experiment was laid out in randomized complete block design with three replications. The plot size was 1m in length, distance between plants was 0.3 m and between plots was 1m. the field pea varieties V1= local, V2= Getar seed and V3= Emma seed were planted in rows on Nov. 14 during winter 2023, while dry peas were harvested on the 12May in 2024winterseason. At green-maturity a sample of five pea plants were collected randomly from each plot and used to measure the following characters: plant Hight (cm) measured from the cotyledonary node to the top of the main stem, number of branches/plants, number of pods/plants, number of seeds/pods, weight of pods (g/plant) and 1000 seeds weight (g).

The long-term average annual rainfall at Gerda Rasha is approximately 411 mm. Rainfall follows a unimodal pattern, with most precipitation occurring between

ISSN 2072-3857

October and April. A period of water surplus extends from mid-November to mid-April, while the remaining months experience water deficiency. January is the coldest month and July is the hottest. During 2023, the mean monthly temperature ranged from 9.3 °C to 36.5 °C. According to the Köppen climate classification, Gerda Rasha is characterized as a Mediterranean climate with mild conditions and hot, dry summers (BSh).

Statistical analysis:

Data were statistically analyzed according to the SPSS (Statistical Package for the Social Sciences) and the means were significant at the 0.05 probability level, means separation was done by using Duncans Multiple Range Test DMRT.

Results and Discussion

Mean squares variance analyses for growth characters and yield

Data of table (1) The mean squares of variance revealed that **variety** had a highly significant effect (**$p \leq 0.01$**) on plant height, number of branches, leaf area, number of pods per plant, yield per plant, and 1000-seed weight, indicating the presence of substantial genetic variability among the tested varieties. However, the effect of variety on number of seeds per pod was not significant, suggesting that this trait was less influenced by varietal differences. Mean squares of weeding periods showed a significant to highly significant influence on most growth and yield attributes. The effects were highly significant (**$p \leq 0.01$**) for number of branches, leaf area, number of pods per plant, yield per plant, and 1000-seed weight, while a significant effect (**$p \leq 0.05$**) was observed for number of seeds per pod. Plant height, however, was not significantly affected by weeding treatments, indicating that weed management practices influenced yield components more than vegetative height.

The **interaction between variety and weeding periods** was significant for number of branches, leaf area, number of pods per plant, yield per plant, and 1000-seed weight, suggesting that varieties responded differently to weeding regimes for these traits. The interaction effect was not significant for plant height and number of seeds per pod.

Table 1. Mean Squares variance analyses for growth traits and yield.

S.O. V	d.f	plant height	no. of branch	leaf area cm^2	no. pod/ plant	no. of seed/ pod	yield gr/ plant	1000 seeds weight
replication	2	672.086*	0.002	114.678*	0.290	0.043	6.379*	0.783*
variety	2	5834.101**	10.632**	7888.521**	106.591**	0.555	164.234**	23.946**
weeding	5	237.463	2.166**	6901.725**	169.611**	2.100*	152.123**	21.576**
V*W	10	284.696	0.609*	3393.040**	12.256*	0.482	23.538**	2.160**
error	34	356.733	0.244	129.167	4.406	0.681	4.475	0.599
total	53							

Effect of varieties on some growth characters and yield

Data in table (2) explain the effect of variety on studied characters. Maximum values for leaf area, No. of seed per pod, seed yield per

ISSN 2072-3857

plant, and 1000 seeds wight recorded by first variety which is Local variety which were 145.39, 5.02, 25.07gr and 30.29 gr respectively, while maximum values of plant height, No. of branch and No. of pod per plant recorded by second variety which is Qetar seed which were 90.18cm, 4.57 and 16.46 respectively, there for the third variety which is France Emma seed recorded lower value for all studied characters compared with another two varieties. contrast to [7] reported that seed per pod was significantly increased under weed control.[8] reported that clear differences among verities produced the greatest number pod per plant, leaf area varied widely, highest pod length and 500-seed weight. The same results were obtained by other researchers [9], [10], [11].

Table 2. Effect of varieties on some growth characters and yield

Variety	plant height cm	No. of branch	leaf area cm^2	no. pod/ plant	No. of seed/ pod	yield g/ plant	1000 seeds weight g
V1	**65.63b**	**4b**	**145.39a**	**16.11a**	**5.02a**	**25.07a**	**30.29a**
V2	**90.18a**	**4.57a**	**143.41a**	**16.46a**	**4.87a**	**21.35b**	**28.57b**
V3	**55.1b**	**3.05c**	**108.18b**	**12.08b**	**4.67a**	**19.08c**	**28.1b**

Effect of weeding periods on some growth characters and yield

Data of table (3) explain the effect of weeding periods on studied characters. Maximum values for No. of branch, leaf area, No. of pod per plant, No. of seed per pod, seed yield per plant and 1000 seeds weight recorded by W_1 or weeding after 15 days after planting which were 4.81, 171.16 cm^2, 23.38, 5.7, 29.99 gr and 31.66 gr respectively, except the highest value for plant height recorded by W_2 or weeding after 15 days from planting showing 74.52 cm, similar results showed by[12]. While the lowest values of leaf area and No. of pod per plant recorded by without weeding were 99.87 cm^2 and 11.79 respectively, and while the W_3 gave the lowest value for plant height recording 60.09cm, while the W_5 weeding after 60 days after planting gave lowest values for No. of branch per plant, No. of seed per pod seed yield per plant and 1000 seeds weight recorded 3.45, 4.44, 19.02gr and 27.39 gr respectively. The same results were reported by [13] and [14]. [15] reported that In these treatments weed population and their growth was inattentive during initial as well as latter stage of crop growth by sequential hand weeding.

ISSN 2072-3857

Table 3. Effect of weeding periods on some growth character and yield

W	plant height	no. of branch	leaf area cm^2	no. pod/ plant	no. of seed/ pod	yield gr/ plant	1000 seeds weight
w0	72.39a	3.59b	99.87e	11.79c	4.59b	20.04bc	27.73d
w1	71.67a	4.81a	171.16a	23.38a	5.7a	29.99a	31.66a
w2	74.52a	3.97b	120.09cd	15.33b	4.78b	21.95b	29.66b
w3	60.09a	3.68b	160.13b	13.52bc	5.11ab	19.76bc	29.02bc
w4	72.05a	3.74b	128.76c	13.05c	4.48b	20.23bc	28.47c
w5	71.11a	3.45b	113.95d	12.23c	4.44b	19.02c	27.39d

Effect of interaction between varieties and weeding periods on some growth characters and yield

Effect of the interaction between varieties and weeding periods on studied characters present in table (4). This effect was significant on all studied characters, maximum plant height was 106.22cm produced by the interaction between V_2W_2, while minimum plant height was 51.5cm gave by interaction between V_3W_3. The highest value for No. of branch, No. of pods per plant, seed yield per plant and 1000 seeds weight were showed by interaction between V_1W_1 which recorded 5.55, 26.55 37.38gr and 32.6gr respectively. While the highest value for leaf area and No. Of seeds per pod recorded by interaction between V_2W_1 which gave 220.1cm^2 and 5.89 respectively. [16] discovered that field pea production loss due to weed competition was unaffected by leaf type, but [17] found that field pea cultivars with leaves were more competitive than those without cultivars.

Regarding to the minimum values notes for leaf area and 1000 seeds weight recorded by interaction between V_2W_5, while the lowest value for No. of branch and No. of pods per plant were recorded by interaction between V_3W_0 which gave 2.33 and 10.37 respectively, although the minimum value for No. of seeds per pod recorded by interaction between V_3W_2 which was 4.00, whereas the lowest value for plant height was gave by interaction between V_3W_3 which recorded 51.5cm, however the interaction between V_3W_5 recorded lowest value for seed yield per plant which was 16.00gr. cultivars that did not have a difference between the weed-free and weedy yields [18]. [19] reported that yield loss due to weeds differed among cultivars.

Table 4. effect of interaction between varieties and weeding periods on some growth characters and yield

VW	plant height	no. of branch	leaf area cm^2	no. pod/ plant	no. of seed/ pod	yield gr/ plant	1000 seeds weight gr
v1w0	81.67abcd	4.11bcde	100.66hij	12efg	4.89abc	23cd	30.2bc
v1w1	77.11abcd	5.55a	158.38bc	26.55a	5.55abc	37.38a	32.6a
v1w2	63bcd	3.67cdef	153.29bcd	15.44bcde	5abc	24.57c	30.2bc
v1w3	52.44d	4cdef	167.95b	16.77bcd	5abc	22.3cde	29.43cd
v1w4	63.22bcd	3.55def	140.54cde	13.55cdefg	5abc	22.7cde	30bc
v1w5	56.33d	3.11fg	151.51bcd	12.33efg	4.67abc	20.44defg	29.3cd

ISSN 2072-3857

v2w0	**82.33abcd**	**4.33bcd**	**89.6ij**	**13defg**	**4.55abc**	**19.99defg**	**26.53fg**
v2w1	**83.44abcd**	**5ab**	**220.1a**	**26.22a**	**5.89abc**	**23.15cd**	**31.13b**
v2w2	**106.22ab**	**5ab**	**118.44fgh**	**18.89b**	**5.33abc**	**22.5cde**	**29.37cd**
v2w3	**76.33abcd**	**4.44bcd**	**218.47a**	**12.55efg**	**5.33bc**	**20.3defg**	**29.7cd**
v2w4	**94.44abc**	**4.55bc**	**128.25efg**	**14.88cdef**	**4.11c**	**21.5cde**	**28.5de**
v2w5	**98.33ab**	**4.11bcde**	**85.61j**	**13.22defg**	**4abc**	**20.63cde**	**26.2g**
v3w0	**53.17d**	**2.33g**	**109.34ghi**	**10.37g**	**4.33ab**	**17.13fgh**	**26.44g**
v3w1	**54.44d**	**3.88cdef**	**135def**	**17.37bc**	**5.67c**	**29.43b**	**31.23b**
v3w2	**54.33d**	**3.25efg**	**88.54ij**	**11.66efg**	**4abc**	**18.77efgh**	**29.4cd**
v3w3	**51.5d**	**2.6g**	**93.96ij**	**11.22fg**	**5abc**	**16.67fgh**	**27.92ef**
v3w4	**58.49cd**	**3.1fg**	**117.5fgh**	**10.7g**	**4.33abc**	**16.5gh**	**26.92fg**
v3w5	**58.67cd**	**3.13fg**	**104.74hij**	**11.15fg**	**4.67a**	**16h**	**26.66fg**

Conclusion

The current study shown that, 15 days after planting, field pea production and its components were significantly impacted by varied weeding periods. The results of this study may be helpful in enhancing field pea crop growth, yield, and quality. In terms of economic feasibility, it is advised for field pea production to use weeding times after 15 days after planting rather than the conventional periods. The current study shown that cultivating field pea varieties with varying weeding intervals results in higher growth parameters, yield, and all of its components.

ISSN 2072-3857

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ISSN 2072-3857