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ROLE OF ORGANIC AND CHEMICAL FERTILIZER ON GROWTH AND YIELD OF TWO CULTIVARS OF PEA (*PISUM SATIVUM* L.)

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Abstract

This experiment was conducted at Farm of Horticulture and Land Scape, Department of Agriculture and Forestry, Mosul University, during growing season 2017-2018 to investigate the effect of five application of fertilizers at rate; Chemical (T1), organic (T2), 3/4 chemical+1/4 organic (T3), 1/4 chemical+ 3/4 organic (T4), 1/2 chemical+ 1/2 organic (T5), on vegetative and yield of two pea cultivars; Local (V1) and Holland Ian (V2). The experiment involved 10 treatments arranged a factorial experiment in split plots system within a Randomized Complete Block Design (RCBD) with three replication. The results could be summarized as following: The interaction of V2 and T2 increased biological yield, number of seeds per pod, and green seeds yield. The interaction ofV1 and T3 increased number of branches per plant, dry matter percentage of vegetative growth, pod weight and pod length. The interaction ofV1 and T4 increased pod number per plant, pods yield per plant and total yield of pods.
Key words: *Pisum sativum* L., Growth, Yield, Organic fertilizer, Pea.

Introduction

Pea (*Pisum sativum* L.) which belongs to family Fabaceae, is one of the important winter vegetables grown in Iraq, and ranked second in economic terms. It is determinate or Indeterminate annual herbaceous plant a adapted to wet climatic conditions (Boras, 1992 and Hassan, 2002). It is a vegetable rich in protein, carbohydrates, phosphorus, iron, magnesium, calcium, riboflavin, niacin, thiamine and ascorbic acid (Watt and Merrill, 1993). Pea crop from an agricultural point of view plays an important role in the agriculture cycle for its contribution to the Nitrogen-Fixing and improved soil fertility (Davies *et al*.,1985). Pea is a vegetable crop that has its own biological and morphological characteristics (Cieslarova *et al*., 2012), but these varieties require good nutrients in the soil to suit their growth, as fertilization is the most important processes of the service of the crop and the important means of production for its impact in the organization of plant physiological processes, especially nutrition of macro nutrients (Abo-Dahe and Al-Younis,1988). The global trend is to words the use of organic materials with animal or plant origin as a source of fertilizer for the purpose of reducing the pollution of the environment and agricultural soils with chemical, and the production of agricultural crops safe for humans and animals and compensation of organic matter, which loses soil as a result of intensive agriculture. Organic fertilizers additionally enhance soil physical and compound properties and decrease the requirements for mineral composts, which is reflected increase of vegetative growth and yield of plants (Al-Taey *et al*., 2018 a). Poultry manure as an organic material is particularly important since it conditions and improves soil fertility and contains all macronutrients and most of the micro-nutrients a addition of organic manure (FYM) (Al-Taey *et a*l., 2018 b). Farhan (2012) showed that a significant differences among organic residue levels the addition with 5 t. ha^{-1} was significantly the best on plant height, number of branches, dry weight of plant, leaves chlorophyll content and total yield of broad bean plants. The fertilization with FYM (Cattle manure) at 48 $m^3.ha^{-1}$ on pea plants significantly increased pod length, pod weight, number of green seeds per pod (Hameda *et al*., 2012). Al-Taey (2018) achieved elevation in pepper growth and yield parameters with organic a fertilization under salinity stress, the poultry and cattle manure were superior increasing plant height, branches number, pods number per plant and pod weight of broad bean plants (Jassim and Al-Dulaimi, 2014). Soil fertilization with chemical or organic fertilizer led to a significant increase in the number of pods per plant, pod length and seed yield of broad bean plants (Jasem *et al*., 2015). Abo-Basha (2016) found that addition 238 kg $N.ha^{-1}$ as chicken manure increased plant length, dry weight of vegetative growth, pod length, pod weight, seeds number per pod and total yield compared with NPK fertilizer (control). Using organic fertilizer (Tea waste) increased plant height and number of grains per plant, used egg shell powder increased number of branches per plant, used egg shell powder, banana peel and tea waste showed positive effect on pod yield (Wazir *et al*., 2018).

Pea cultivars differ in morphological and genetic characteristics; it may be divided in to determinate and

indeterminate growth, or on plant length, seed sense. The Climate cultivar increased pod length, number of branches, green pods yield per plant and per hectare (Achakzai and Bangulzai, 2006). El-Shaikh (2010) found that the early perfection cultivar increased number of pods per plant, pods yield, but Master B cultivar increased number of seeds per pod. The Local crinkled cultivar increased plant length, dry matter percentage of vegetative growth, number of pods per plant and green pods yield compared with Local smooth and Canadian cultivars (Dohuky *et al*., 2011). The Climax cultivar increased number of pods per plant, while Metero cultivar increased pod length and number of seeds per pod (Ashraf *et al*., 2011). Al-Saleem (2017) observed that Mezza Rama cultivar increased plant length, number of branches per plant, chlorophyll of leaves, dry matter percentage of vegetative growth, pod length, biological yield and seeds yield per plant and hectare compared with Little Marvel cultivar. The Local cultivar of faba bean increased branches number, Pods number per plant, Seeds number per pod and Seeds yield, compared with Holland Ian cultivar (Dhary and Al-Baldawi, 2017).

Materials and Methods

The experiment was conducted in the vegetable field of the Department of Horticulture and Landscape, college of Agriculture and Forestry, University of Mosul, during 2017-2018, to study the effect of two pea cultivar; Local and Holland Ian, and application chemical fertilizer NPK 18-18-18 at 200 $kg.ha^{-1}$(T1), organic manure (Atalapolina) dry poultry manure Italian origin, manufacture from, at 400 $kg.ha^{-1}$ (T2), 3/4 chemical + 1/4 organic (T3), 1/4 chemical + 3/4 organic (T4), 1/2 chemical + 1/2 organic (T5).Prior to the beginning of the experiment random soil samples from 0-30 cm were obtained and analyzed at the Department of Horticulture to determine soil physical and chemical properties (Table1).

Table 1: Physical and chemical properties of soil.

Sand $g.kg^{-1}$	Loam $g.kg^{-1}$	Clay $g.kg^{-1}$	N $mg.kg^{-1}$	P $mg.kg^{-1}$	K $mg.kg^{-1}$	O.M $mg.kg^{-1}$	pH	EC dsm^{-1}
648.1	229.8	122.1	24.20	15.81	126.65	19.33	7.8	0.744

The soil sample was analyzed in the Soil and Water Resources Department Laboratories / College of Agriculture and Forestry/Mosul University.

Table 2: Properties of organic manure (Atalpolina).

N	P_2O_5	K_2O	Mgo	Fe	B	C	O.M	H.A.	F.A	A.A	pH
4%	4%	4%	0.5%	0.08%	0.2%	41%	70.7%	5%	12%	25%	7

Addition chemical fertilizer two times, first after sowing one month, second at flowering stage, but addition organic and other treatment after sowing one month. Work rows the distant between row and anther 0.70 m, number of rows in each plot 2 rows, the length of row 2 m, area of plot 2.8 m^2 (1.4 × 2), seed sowing 12 November/ 2017, the distance between plants 0.25 m, number of plants in each row 8 plans and in each plot 16 plants. Number of plots in each replicate 10 (Treatments 2×5). The experiment was arranged in a split plot within a randomized complete block design (RCBD), with treatment with cultivars as the main plot and fertilizer treatment as the sub-plot with 3 replications. Before pod harvesting the following attributes have been read: 1- Biological yield. 2-Chlorophyll contend in leaves (SPAD). 3- Plant higher. 4- Branch number per plant. 5- Dry matter percentage of vegetative growth, After pods harvesting the following attributes have been read: 1- Number of pods per plant. 2- Pods yield per plant. 3- Seeds number per pod. 4- Pod weight. 5- Pod length. 6- Green seeds yield ($kg.\ ha^{-1}$). 7- Total yield of pods ($t.ha^{-1}$). The results were statistically analyzed according to the design used by the SAS program (2001) at 0.05 level.

Results and Discussion

The anova indicated that cultivar not a affected, fertilizer, and the interaction effected measured variables, fertilizer affected biological yield, chlorophyll content in leaves, plant higher, dry matter percentage of vegetative growth and number of pods per plant (Table 2). The interaction of cultivar and fertilizer affected all growth parameters and number of pods per plant (Table 3). The highest biological yield with C.V. Holland Ian and organic fertilizer. The greatest chlorophyll content in leaves with C.V. Local and 1/2 chemical+ 1/2 organic fertilizer. The highest plant higher with C.V. Holland

Ian and chemical fertilizer. The greatest number of branches per plant and dry matter percentage of vegetative growth with C.V. Local and 3/4 chemical+ 1/4 organic fertilizer (Table 3).

Differences between fertilizers as they affect Biological yield, plant higher and dry matter percentage of vegetative growth due to the components of these nutrients, especially nitrogen, which enters the structure of the protein, DNA, and RNA, this increase increases the mass of protoplasm and cell division and cause increasing vegetative growth (Al-Sahaf *et al*., 2011). Fertilizer is one of the most effective factors causing changes in plant chemical composition and improved crop quality and quantity. Application of organic fertilizer to gather with C.V. Holland Ian was best for biological yield, plant higher, dry matter percentage of vegetative growth. These results agreed with (AlTaey and Majid, 2018) which they mention to improve the lettuce growth and the yield, with different of organic fertilizers sources.

Table 2: Anova responses due to cultivars, chemical, organic fertilizer and their interaction on vegetative parameters and pods number per plant.

Source	Biological yield per plant	Chlorophyll content in leaves	Plant higher (cm)	Branches number per plant	Dry matter of vegetative growth%	Pods number per plant
Cultivars	ns	ns	ns	ns	ns	ns
Fertilizers	*	*	*	ns	*	*
Interaction C×F	*	*	*	ns	*	*

ns, * not significant or significant at $p< 0.05$, ANOVA.

Table 3: Interaction effect due to cultivars, chemical, organic fertilizer and their interaction on vegetative parameters and pods number per plant.

Cultivars × Fertilizer		Biological yield per plant (gm)	Chlorophyll content in leaves	Plant higher (cm)	Nu. of branches per plant	Dry matter of vegetative growth %	Pods number per plant
C.V. Local (V1)	T1	176.00 d	47.76 ab	50.88 abc	2.72 ab	23.71 c	23.42 cde
	T2	214.67 bc	49.23 a	55.22 ab	2.44 ab	26.57 bc	29.37 abc
	T3	230.67 b	47.50 ab	54.66 ab	2.88 a	34.91 a	26.68 bcd
	T4	242.00 b	45.56 abc	55.11 ab	2.61 ab	27.20 bc	36.35 a
	T5	216.00 bc	49.23 a	55.77 ab	2.33 ab	31.18 ab	22.21 cde
C.V. Holland Ian (V2)	T1	214.00 bc	46.30 abc	58.55 a	2.49 ab	26.10 bc	31.95 ab
	T2	421.00 a	40.56 cd	53.77 ab	2.44 ab	23.61 c	29.82 abc
	T3	144.00 e	42.00 bcd	51.00 abc	2.22 ab	26.13 bc	25.03 bcd
	T4	189.00 cd	43.66 abc	54.88 ab	2.50 ab	27.22 bc	21.09 de
	T5	189.00 cd	40.53 cd	55.11 ab	2.00 b	28.83 abc	22.30 cde

The interaction was analyzed with according Duncan's multiple at the 5% levels and means were separated with letters.

The ANOVA indicated that cultivar affected only of green seeds yield, fertilizers and interaction affected of all measured variables (Table 4). Cultivars, fertilizers and interaction-affected number of seeds per pod, pod weight, pod higher, number of pods per plant, pods yield per plant, green seeds yield and total yield of pods (Table 5). The greatest number of seeds per pod and green seeds yield were due to treatment with C.V. Holland Ian and organic fertilizer. The highest pod weight and pod length were due to treatment with C.V. Local and 3/4 chemical + 1/4 organic fertilizer. The highest pods yield per plant and total yield of pods were due to treatment with c.v. Local and 1/4 chemical + 3/4 organic fertilizer.

Differences between fertilizers as they affect yield and its companied due to a mounts of nutrient provided to plants and effects on physiological function within the plant (AL-Nuaimi, 1999). Fertilizer is one of the most effective factors causing changes in plant chemical composition and improved crop quality.

Table 4: ANOVA responses due to cultivars, chemical, organic fertilizer and their interaction on yield parameters.

Source	Nu. of seeds per plant	Pod weight (gm)	Pod length (cm)	Pods yield per plant (gm)	Green seeds yield ($kg.ha^{-1)}$	Total yield of pods ($t.ha^{-1}$)
Cultivars	ns	ns	ns	ns	*	ns
Fertilizers	*	ns	*	*	*	*
Interaction C×F	*	*	*	*	*	*

ns, * not significant or significant at $p< 0.05$, ANOVA.

Table 5: Interaction effect due to cultivars, chemical, organic fertilizer and their interaction on yield parameters.

Cultivars × Fertilizer		Number of seeds per plant	Pod weight (gm)	Pod length (cm)	Pods yield per plant (gm)	Green seeds yield ($kg.ha^{-1)}$	Total yield of pods ($t.ha^{-1}$)
C.V. Local (V1)	T1	5.86 ab	5.71 ab	7.32 a	96.45 bcd	162.00 abc	5.143 bc
	T2	6.30 ab	5.67 ab	7.53 a	105.74 abc	124.00 d	5.639 ab
	T3	6.06 ab	6.47 a	7.70 a	112.07 abc	141.67 cd	5.976 ab
	T4	5.91 ab	5.47 ab	7.70 a	132.10 a	141.00 cd	7.045 a
	T5	5.73 ab	5.74 ab	7.18 ab	99.16 bcd	136.67 cd	5.288 bc
C.V. Holland Ian (V2)	T1	6.02 ab	5.81 ab	7.66 a	102.38 bcd	157.33 a-d	5.452 bc
	T2	6.61 a	5.70 ab	7.60 a	120.02 ab	190.00 a	6.400 ab
	T3	6.10 ab	5.75 ab	7.60 a	114.18 abc	179.33 ab	6.089 ab
	T4	5.36 b	6.43 ab	7.67 a	108.97 abc	153.00 cd	5.811 ab
	T5	5.23 b	5.87 ab	8.46 a	107.00 abc	164.00 abc	5.706 ab

The interaction was analyzed with according Duncan's multiple at the 5% levels and means were separated with letters.

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