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The Dual Effect of Bio and Organic Fertilization on Yield, its Components and Chemical Composition of Two Chickpea Varieties

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TWO Field experiments were carried out during 2006/07 and 2007/08 winter seasons at the Farm of Research and Production Station, National Research Centre, Al Emam Malek Village, Nubaria District, Al Behaira Governorate, Egypt, to study the dual effect of bio and organic fertilization on yield and yield components of two chickpea local varieties. Experimentwas included 12 treatments which were the combinations between 2 varieties (Giza-531, large seeds and Giza -3, small seeds), 3 fertilization treatments (recommended NPK 20:30:24 – recommended rate of organic fertilizer 3 ton/fed. as composted rice residues (50% NPK +50% composted rice residues) with or without biofertilizer (mycorrhiza), in split with 3 replicates. The studied characters were: plant height; no. of branches/plant; no. of seeds/ capsule; no.of capsules/plant; seed index (weight of 100 seed); seed yield/plant; seed yield/fed; biological yield/fed; harvest index; protein in seeds. Data indicated that c.v Giza- 531 surpassed c.v Giza-3 in all studied characters. The dual effect of 50% rec.NPK + 50% rec.composted rice residues with (mycorrhiza) recorded the best results for most studied characters.

Keywords: Chickpea, NPK, Composted, Rice, Residues, Mycorrhiza.

Chickpea (*Cicer arietinum* L.) is consider as one of the most important seed legumes worldwide *i.e.,* Asia and North Africa (You., 2005). In Egypt it ranks third after faba bean and lentil from the stand point of importance as legume crop, the cultivated area were 15.1thousand feddan in 2006 with mean production 932.5 kg/ fed. (AER, 2007). It is an important source of cheap protein with high energy, nutritive value and protein quality compared with peas and lupins, (Nalle *et al.*, 2005). Seeds consumed dry by parched or cooked in human diets, in sweet manufacture and recently in baby food blends (El kramany and Bahr, 1999). It is often used as an alternative protein product with vegetarians and vegans and one of the plants with high amount of protein 23%, carbohydrates 63%, fat 5%, crude fiber 6% and ash3%. Chickpea is a good source of zinc, folate also, very high in dietary fiber and thus is a healthy food source, especially as a source of carbohydrates for persons with insulin sensitivity or diabetes. It has low content of fat, and most of at content is polyunsaturated also, a good source of calcium (190 mg/100 g) which were equal to yogurt and close to milk. Chickpea varieties differed in many characters *i.e.,* branching, seed size, early mature, high yield and high protein content. In Egypt there were two groups *i.e.,* (small seeds weight of 100 seeds 13-16 g and large seeds 22-30 g). Rice residues is one of the most important problem faced rice

crop producers but utilization composted rice residues as organic fertilizer is the main target to recycle rice residues without loss in biomass of rice residues or air pollution by burning it. Beneficial effect of bio-organic fertilization in chickpea especially in sandy soil were reported by many researchers, (Amany 1997; Hafiz 2004; Saini *et al.*, 2004; Delowara *et al.*, 2006; Jain *et al.*, 2006; Bhatnagar and Kaurav 2007; Seema *et al.*, 2007).The aim of this work was to evaluate the dual effect of bio and organic fertilization to reduce NPK chemical fertilizer for two types of chickpea varieties (small and large) in sandy soil at Nubaria District, Al Behaira Governorate, Egypt.

Material and Methods

Two field trials using two chickpea local varieties were conducted at Research and Production Station, National Research Centre Al Emam Malek Village Nubaria District Al Behaira Governorate, Egypt 2006/07 and 2007/08 winter seasons to study the dual effect of bio and organic fertilization on yield and yield components. The experimental soil was analyzed according to the method described by (Chapman and Pratt 1978). Soil texture was sandy and having the following characteristics: sand 91.2 %, silt 3.7 %, clay 5.1%; pH 7.3; organic matter 0.3 %; $CaCO_3$ 1.4 %; E.C. 0.3 dS/m; soluble N 8.1 ppm and available P 3.2 ppm, exchangeable K 20 ppm. Chickpea seeds were previously inoculated with the specific strain of mycorrhiza *(Glomus macrocarpium)*, from Gottingen University, Germany, and was mixed with the soil were sown in the last week of October in both seasons in plots 10.5 m^2, 1/400 Fed. (5 ridges, each 3m in length and 0.7 m in width) in hills 20 cm apart. Calcium superphosphate 15.5% P_2O_5 at recommended dose of P_2O_5 31 kg/fed. or half dose P_2O_5 15.5 kg/fed. were applied before ridging also, organic fertilizer in the form of composted rice residues at the recommended dose 3 ton/fed. and half dose 1.5 ton/fed. were applied before ridging, chemical composition of the organic fertilizer as follows: dry weight of 1 m^3 460 kg, pH 8.8 , organic matter 36.56 %, C/N ratio 1:16.8 , N 1.24 %, P 0.58 %, K 1.15 %. Three weeks after sowing plants were thinned to two plants/ hill. Then recommended dose N 20 kg/fed. and half dose N 10 kg/fed. As ammonium nitrate 33.5% N were applied. The experimental design was split plot design in three replicates. Treatments were combinations between 2 varieties (Giza-531, large seeds and Giza -3, small seeds) and The Bio and organic fertilization treatments:
A) 100 % rec.100 % rec. NPK chemical fertilizer; B) 100% recommended NPK chemical fertilizer + (mycorrhiza); C) 100 % rec. organic fertilizer; D) 100 % rec. organic fertilizer + (mycorrhiza); E) 50 % rec. NPK chemical + 50 % rec. organic fertilizer and F) 50 % rec. NPK chemical + 50 % rec. organic fertilizer + (mycorrhiza).

Chemical fertilizers were added in two levels:-first 100% recommended dose which were 20 kg N/fed. in the form of ammonium nitrate 33.5% N-31 kg P_2O_5/ fed. as calcium superphosphate 15.5% P_2O_5 – 24 kg K_2O /fed. as potassium sulphate 48% K_2O and second level was 50% recommended dose:- 10 kg N/fed.+15.5 kg P_2O_5 /fed. + 12 kg K_2O /fed., organic fertilizer recommended dose was 3 ton/fed. in the form of composted rice residues.

At harvest 150 days after sowing two central ridges were harvested and sub samples of 10 plants, were taken randomly to estimate thefollowing yield attributes: 1) Plant height (cm); 2- Number of branches/plant; 3- Number of seeds/capsule; 4) Number of capsules/plant; 5) Seed index (weight of 100 seeds, g) and 6) Seed yield (g/plant).

The whole plot was harvested to determine: 1) Seed yield (kg/fed.); 2) Straw yield ton/fed; 3) Biological yield (ton/fed.); 4) Harvest index (seed yield/bio-yield; 5) Protein% in seeds and 6) Protein yield (kg/fed.), Protein yield was determined by multiplying protein% in seeds and seeds yield in kg/fed.

Total N-content in seeds determined and protein% was calculated by multiplying N-content by 6.25 according to Chapman and Pratt (1978).

All data were statistically analyzed and combined analysis was conducted for the data of the two seasons according to Snedecor and Cochran (1990).The least significant difference (LSD at P=0.05) was used to compare between means

Results and Discussions

Varietal differences

As shown in Table 1 the variety Giza 531 had a significant difference with regard to the variety Giza 3 in all the studied characters except for the number of seeds per capsule where the significant difference was disappeared. The variety Giza 531 surpassed its counterpart, Giza 3 by 8.2% in plant height, 10.4% in number of branches/plant, 13.1% in number of capsules/plant, 70.3% in seed index, 64.1% in seed yield/plant, 14.50% in seed yield/fed., 2.64% in straw yield 5% in biological yield/fed., 9.50% in harvest index, 0.30% in protein% and 14.68% in protein yield. The surpassing of variety Giza 531 upon the variety Giza 3 in seed yield/fed. may be due to the difference in genetic composition and its interaction with the environment of the experimental site under the favorable combination of the fertilizers. From the aforementioned results, it is obvious that Giza 531 grown much better than Giz 3 in the new reclaimed sandy soils in Nubaria where the growth conditions were favorable to its development than the variety Giza 3.

TABLE 1. Effect of varieties on yield and yield components of chickpea.

	Giza 531	Giza 3
Plant height, cm	62.14 a	57.41 b
Number of branches/plant	7.94 a	7.19 b
Number of seeds/capsule	1.83 a	1.86 a
Number of capsules/plant	49.97 a	44.17 b
Seed index(g)	26.64 a	15.64 b
Seed yield, g/plant	23.08 a	14.05 b
Seed yield, Kg/fed	823.61 a	719.17 b
Straw Yield, Ton/fed	2.72 a	2.65 a
Biological yield Ton/fed	3.54 a	3.37 b
Harvest index	0.23 a	0.21 b
Protein%	23.00 a	22.93 a
Protein yield, Kg/fed.	189.19 a	164.97 b

Effect of combination between bio, organic, and chemical fertilizers and its effects on yield and yield components of chickpea

Table 2 revealed that the combinations of bio, organic and chemical fertilizer treatments had a significant effect on all the studied characters except for harvest index. The same tables illustrated that the combination of biofertilizer (mycorrhiza) + organic fertilizer (50 % of its recommended dose) + chemical fertilizer (50 % of its recommended dose), treatment mycorrhiza + 50 % recommended NPK + 50 % organic fertilizer recommended recorded the highest plant height (62.42 cm) and number of branches/plant (8.00). However, the fertilization with organic fertilizer only, treatment of 100 % organic fertilizer gave the lowest plant height (57.00 cm) and number of branches/plant (6.92). Data presented in Table 2 demonstrated the same trend where the treatment mycorrhiza + 50 % recommended NPK + 50% organic fertilizer gave almost the highest number of capsules/plant (47.50), seed index (22.25), seed yield (19.42 g/plant), seed yield (805.00 kg/fed.) and protein yield (186.13 kg/fed).

However, the treatment of 100% organic fertilizer recorded the lowest values for the previous characters, (46.92, 20.33, 17.67 g/plant, and 722.50 kg/fed.) for the above characters respectively. The treatment (mycorrhiza) +100% recommended NPK recorded the highest values of number of seeds/capsules (1.95), straw yield (2.84 ton/fed), protein % (23.25%) and biological yield (3.64 ton/fed.), with no significant difference with the treatment mycorrhiza + 50% recommended NPK + 50% organic fertilizer. In conclusion, it is seemed that the treatment mycorrhiza + 50% recommended NPK + 50% organic fertilizer was the best treatment for producing the highest seed yield/fed. of chickpea , this may be due to the symbiotic effect of mycorrhiza and microorganisms in the organic fertilizer in addition to the effect of chemical fertilizer on seed yield. Results were in accordance with those obtained by Hafiz (2004); Jain *et al.* (2006); Bhatnagar and Kaurav (2007) and Seema *et al.* (2007).

Effect of interaction between varieties and bio and organic fertilizers on yield and yield components of chickpea

Table 3 showed that the two varieties responded differently to the combinations of fertilizers treatments where the variety Giza 531 recorded the highest plant height (67.00 cm), number of branches/plant (8.50), and number of capsules/plant (51.17) at the treatment of mycorrhiza +100% recommended NPK. However, the variety Giza 3 gave the lowest values (51.50 cm, 5.83, and 43.33) for the above characters, respectively, at the treatment of Mycorrhiza + 50% recommended NPK + 50% organic fertilizer. The interaction for all the other characters was not significant at 5% level.

TABLE 2. Effect of combinations of bio, organic, and chemical fertilizers on yield components of chickpea.

Treatments Character	100% recommended NPK	mycorrhiza +100% recommended NPK	100% organic fertilizer	Mycorrhiza +100% organic fertilizer	50% ecommended NPK + 50% organic fertilizer	Mycorrhiza +50% recommended NPK + 50% organic fertilizer
Plant height. cm	58.00 c	59.50 b	57.00 d	62.08 a	59.67 b	62.42 a
Number of branches/ plant	7.50 abc	7.92 a	6.92 c	7.83 ab	7.25 bc	8.00 a
Number of seeds/ capsules	1.89 abc	1.95 a	1.68 d	1.83 bc	1.82 c	1.91 ab
Number of capsules/ plant	46.58 c	47.17 ab	46.92 bc	47.50 a	46.75 bc	47.50 a
Seed index(g)	20.83 cd	21.08 bc	20.33 d	22.25 a	21.58 b	22.25 a
Seed yield, g/plant	18.33 c	19.08 ab	17.67 d	18.42 c	18.50 bc	19.42 a
Seed yield, Kg/fed	770.00 ab	797.50 a	722.50 c	749.17 bc	784.17 ab	805.00 a
Straw Yield, Ton/fed	2.77 ab	2.84 a	2.54 d	2.60 dc	2.64 bcd	2.72 abc
Biological yield Ton/fed	3.54 ab	3.64 a	3.27 d	3.35 cd	3.42 bc	3.52 ab
Harvest index	0.218 a	0.219 a	0.227 a	0.224 a	0.229 a	0.228 a
Protein%	22.93 a	23.25 a	22.75 a	22.93 a	22.81 a	23.12 a
Protein yield, Kg/fed.	176.57 bc	185.43 ab	164.38 d	171.80 cd	178.88 abc	186.13 a

TABLE 3. Effect of interaction between varieties and bio and organic fertilizers on yield components of chickpea.

Treatments Character	varieties	100% recommended NPK	mycorrhiza +100% recommended NPK	100% organic fertilizer	Mycorrhiza +100% organic fertilizer	50% ecommended NPK +50% organic fertilizer	Mycorrhiza + 50% recommended NPK + 50% organic fertilizer
Plant height, cm	Giza 531	62.50 bc	56.33 d	62.50 bc	61.00 c	63.50 b	67.00 a
	Giza 3	53.50 e	62.67 b	51.50 f	63.17 b	55.83 d	57.83 d
Number of branches/ plant	Giza 531	7.83 ab	7.67 ab	8.00 ab	7.50 ab	8.17 ab	8.50 a
	Giza 531	49.83 b	48.67 c	50.50 ab	49.67 b	50.00 b	51.17 a
Number of seeds/ capsules	Giza 531	1.90 a	1.93 a	1.63 a	1.80 a	1.85 a	1.88 a
	Giza 3	1.88 a	1.97 a	1.73 a	1.87 a	1.78 a	1.93 a
Number of capsules/ plant	Giza 531	49.83 b	48.67 c	50.50 ab	49.67 b	50.00 b	51.17 a
	Giza 3	43.33 e	45.67 d	43.33 e	45.33 d	43.50 e	43.83 e
Seed index(g)	Giza 531	26.67 a	26.67 a	25.83 a	26.33 a	27.00 a	27.33 a
	Giza 3	15.00 a	15.50 a	14.83 a	15.17 a	16.17 a	17.17 a
Seed yield, g/plant	Giza 531	22.67 a	23.50 a	22.33 a	23.00 a	23.17 a	23.83 a
	Giza 3	14.00 a	14.67 a	13.00 a	13.83 a	13.83 a	15.00 a
Seed yield, Kg/fed	Giza 531	810.00 a	850.00 a	763.033 a	806.67 a	841.67 a	870.00 a
	Giza 3	730.00 a	745.00 a	681.67 a	691.67 a	726.67 a	740.00 a
Straw Yield, Ton/fed	Giza 531	2.79 a	2.93 a	2.57 a	2.61 a	2.65 a	2.76 a
	Giza 531	2.75 a	2.75 a	2.51 a	2.59 a	2.62 a	2.68 a
Biological yield Ton/fed	Giza 531	3.60 a	3.78 a	3.33 a	3.42 a	3.50 a	3.63 a
	Giza 3	3.48 a	3.50 a	3.20 a	3.28 a	3.35 a	3.42 a
Harvest index	Giza 531	0.225 a	0.224 a	0.230 a	0.237 a	0.240 a	0.240 a
	Giza 3	0.210 a	0.213 a	0.214 a	0.211 a	0.217 a	0.217 a
Protein%	Giza 531	22.96 a	23.28 a	22.78 a	22.96 a	22.84 a	23.15 a
	Giza 3	22.90 a	23.22 a	22.72 a	22.90 a	22.78 a	23.09 a
Protein yield, Kg/fed.	Giza 531	185.97 a	197.88 a	173.89 a	185.21 a	192.24 a	201.40 a
	Giza 3	167.17 a	172.99 a	154.87 a	158.39 a	165.53 a	170.86 a

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التاثير المزدوج للتسميد الحيوى والعضوى على المحصول ومكوناته والتركيب الكيماوى لصنفين من الحمص

محمد فاروق القرمانى ، عمر مغاورى ابراهيم ، الهام عبد المنعم بدر و محمد عبد المنعم أحمد
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اجريت تجربة حقلية خلال الموسمين الشتويين ٢٠٠٧/٢٠٠٦ ، ٢٠٠٨/٢٠٠٧ بمحطة البحوث و الانتاج بالمركز القومى للبحوث – قرية الامام مالك-قطاع النوبارية – محافظة البحيرة – مصر. استهدفت التجربة دراسة التاثير المزدوج للتسميد الحيوى والعضوى على المحصول ومكوناته على صنفين من الحمص. احتوت التجربة على عاملين للدراسة:
أولا- الاصناف: ٢ صنف – جيزة ٥٣١ (بذرة كبيرة)- جيزة ٣ (بذرة صغيرة)
ثانيا- التسميد الحيوى والعضوى والكيماوى: ٦ توافيق هى:

١- ١٠٠ % من المعدل الموصى به من الاسمدة الكيماوية.
٢- التسميد الحيوى (ميكورهيزا) + ١٠٠ % من المعدل الموصى به من الاسمدة الكيماوية ن ٢٠ + فو٢ أ٥ ٣١ + بو٢ أ ٢٤.

٣- ١٠٠ % من المعدل الموصى به من السماد العضوى.

٤- التسميد الحيوى (ميكورهيزا) + ١٠٠ % من المعدل الموصى به من السماد العضوى.

٥- ٥٠ % من المعدل الموصى به من الاسمدة الكيماوية + ٥٠ % من المعدل الموصى به من السماد العضوى.

٦- التسميد الحيوى (ميكورهيزا)+ ٥٠ % من المعدل الموصى به من الاسمدة الكيماوية + ٥٠ % من المعدل الموصى به من السماد العضوى (٣ طن/الفدان كومبوست قش الارز).

استخدم تصميم القطع المنشقة حيث وضعت الاصناف فى القطع الرئيسية ورتبت معاملات التسميد عشوائيا فى القطع المنشقة فى ثلاث مكررات. وأظهرت النتائج تفوق الصنف جيزة ٥٣١ على الصنف جيزة ٣ فى اغلب الصفات المدروسة وكذا اعطت معاملة : التسميد الحيوى (ميكورهيزا)+ ٥٠ % من المعدل الموصى به من الاسمدة الكيماوية + ٥٠ % من المعدل الموصى به من السماد العضوى اعلى القيم فى معظم الصفات مقارنة بباقى معاملات التسميد بينما اعطى التفاعل ما بين الصنف جيزة ٥٣١ و المعاملة : التسميد الحيوى (ميكورهيزا)+ ٥٠ % من المعدل الموصى به من الاسمدة الكيماوية + ٥٠ % من المعدل الموصى به من السماد العضوى افضل النتائج فى اغلب الصفات المدروسة خاصة محصول بذور الحمص كجم / الفدان و محتواها من البروتين و محصول القش و المحصول البيولوجى /الفدان.