Biological Forum – An International Journal **6**(1): 33-41(2014)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Examining the Effect of Phosphate Manure and Mycorrhizal and their Interaction with Vermicompost on Performance and Functional Components of Groundnut

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(Received 09 December, 2013, Accepted 31 January, 2014)

ABSTRACT: This study was conducted to examine the effect of phosphate manure and mycorrhizal and their interaction with vermicompost on performance and components of the groundnut plant in a factorial experiment with three factors that included mycorrhizal fungus (inoculation and non-inoculation), phosphate manure (0, 30 and 60 Kg/ha), and vermicompost (0, 5 and 10 tons/ha) in random blocks schemes with 18 treatments and three iterations in crop year 1390 in Astaneashrafie, kourka region. The results of stepwise regression revealed that effective features on performance of groundnut included number of seed per square meter and weight of 100 seeds. Therefore, the above mentioned features were analyzed statistically with seed function. Phosphate manure gained the highest performance on all evaluated features, especially seed performance with 60 kg utilization per hectare, about 2775 kg. based on means comparison experiment with Danken method, utilization of vermicompost in the level of 10 tons per hectare , had better performance than control. Inoculation with mycorrhizal relative to non –inoculation in the above mentioned features caused improvement in performance. There was a significant interaction between mycorrhizal with phosphor amount and mycorrhizal with vermicompost amount on all observed features. Also in comparison with the average of the interaction among examined factors, the highest seed performance was observed in interaction of phosphate manure × mycorrhizal fungus and in 60 kg level phosphate manure in the presence of mycorrhizal fungus, that its performance was 2861 kg per hectare. Also the interaction of phosphate and vermicompost manure had the highest performance in 60 kg of phosphate manure and 10 tons of vermicompost with 3134kg per hectare. Interaction of the 3 factors on seed performance in 60 kg level of phosphate and 10 tons of vermicompost and inoculation with mycorrhizal had the highest amount relative to other levels and control so that it caused improvement of performance of seed about 657 kg per hectare, more than control performance.

Keywords: Groundnut, Mycorrhizal fungus, Vermicompost, Phosphate manure.

INTRODUCTION

Groundnut plant (*Arachis hypogea* L.) is a crop cultivated in tropical to semi-temperate regions for its and high protein, nutritional and oil purposes (Vinve Gamguri1982). Considering the fact that this plant is a especial of tropical regions, it can be grown in latitudes between 40 in north and 40 in south with the amount of 500ml rain in growth season and temperature between 24 to 33c (Gibonz, 1980). In recent years, misusage of chemicals in farm lands caused severe environmental problems including pollution of water sources, degradation in quality of agricultural crops and alleviation of soil fertility (Sharma, 2002). One of the foundations of sustainable agriculture is to use biologic manures in order to provide nutritional elements of the plant with the purpose of significant alleviating or eliminating chemicals .biological manures contain material retentive of the condensed population of one or several beneficial terricolous microorganism, that causes improvement of soil and suitable distribution of required nutrition of the plant in a sustainable agricultural system.(Galen Rastin, 2004). Global approach is important in establishing such system. In this regard, we can refer tomycorrhizal fungus and vermicompost. Mycorrhizal fungus has symbiosis with the root of majority of the plants, that by increasing absorption of nutritional elements like phosphor and some of low utilization elements, increasing water absorption, decreasing negative effects of environmental tensions, resistance against pathogenic factors etc. causes increase of the plant growth and plant performance in sustainable agriculture system (Sharma, 2002a). In a research conducted by Subramanian *et al* (2006) on tomato, they indicated that symbiosis of tomato with one species of mycorrhizal causes significant increase of flora per bush in comparison with control treatment.

Kapoor *et al* (2004) in a study suggested significant increase of canopy per bush, that was due to the inoculation of fennel with mycorrhizal fungus. Vermicompost is the result of the biologic activity of a kind of worm. This worm feeds from organic materials in nature and transfers it to organic manure.

In fact vermicompost is the result of natural digestion of food in worm's digestion system, that accelerates development period of the plant via having microorganism and organic material, while absorbing water in a large amount, provide the suitable condition for seed making and the power to preserve the required nutrition of the plant (Allan con *et al*, 2001). In a study conducted by Anwar *et al*, it was observed that using 5 tons of vermicompost with chemical fertilizers per hectare caused improvement of biologic performance of a kind of herbal plant called sweet basil. Kail *et al* report also indicated that using vermicompost by stimulating root growth caused increase of percentage of symbiosis in the root of a kind of herbal plant called rosemary. Kamawat *et al* (2006) also suggested that vermicompost caused increase of biologic performance in barely. Phosphor is one of vital elements that exists in a large amount and in the form of mineral and organic compounds in nature. Plants can absorb the inorganic phosphate of a solution that usually its amount is lee than plant's required nutrition and the resultant lack of phosphor, in addition to decrease growth will effect on flower, fruit, seed and quality constitution of the plant. Stanilva (1975) concluded that phosphor utilization increases development of node in groundnut and increased fixed (established) azote. Olsen *et al* (1961) also suggested that sufficient phosphor can increase depth of root and in this way can facilitate absorption through deeper layers of soil. Regarding the importance of agricultural systems in the world and using biologic fertilizers in system and in order to improve qualitative and quantitative performance of farm crops, this study was conducted to examine the effect of utilization of biologic fertilizers on growth indices and performance of groundnut.

MATERIALS AND METHOD

The experiment was conducted in a lot in a village named'' kourka'' of Astane town in 49degrees and 46 minutes of eastern longitude and 37 degrees and 11 minutes of northern latitude .the above mentioned crop of the lot in the last year was watermelon. The average of rain in the crop year 90-91 was about 511 ml and the unsuitable dispersion and drought period since late june to early august was about 2 months. Minimum and maximum of mean temperature was +3% and +20/4 respectively. This study was conducted in a factorial experiment (2 + 3 + 3) in completely random blocks with three iterations. Factors included:

1. Mycorrhizal in 2 levels, inoculation (M2) and non-inoculation (M1)
2. Phophate in 3 levels p1 = 0, p2 = 30, p3 = 60 kg per hectare.
3. Vermicompost in 3 levels v1 = 0, v2 = 5, v3 = 10 tons per hectare. Therefore each iteration has 3 × 3 × 2 = 18 experimental unit (kert), which is totally 54 kert. According to the results, and based on the laboratory recommendation, an amount of 200 kg per hectare, sulphur element was smeared with tiobasilus inoculation liquid due to high PH amount (7/84)relative to suitable PH for groundnut (5/8-6/2), and was added to the ground before plough. Also 15 kg per hectare boric acid, 50kg per hectare potassium chloride and 50 kg per hectare urea fertilizer was sprayed on the earth. The recommended amount of super phosphate was 75kg per hectare that was distributed according to the scheme and determined amount. In the middle of Ordibehesht plough started with tractor and in late of Ordibehesht, disk operations were performed in order to grind clog and burry green weeds. Mycorrhizal fungus was a usage of Glomusmosseae kind that was provided from zistfanavaranetouran company. And its production date is 90/1/10.

Table 1 : The results of the experimental soil.

Soil	Sand %	Silt %	Clay %	pH	P_2O mg/kg	K mg/kg	So_4 meq/L	Ca meq/L	B mg/kg
Silt loam	41.5	52	6.5	7.84	14.5	166.67	0.44	3.2	0.15

According to the advice of manufacturer about 10 g fungus was located in depths of 10 cm of soil (5 cm below the seeds that required inoculation). Before planting, in prepared kerts, Vermicompost was blended with soil in determined amount. The used seeds were chosen of a local kind (flori Spanish). In order to control weeds the farm was weed in three stages and manually treating with clay and stucco was done simultaneously with the third stage.

Measured features

Rezaei and Soltani (1877) stated that in experiments with more than 2 comparative treatments and quantitative levels of treatments it is best to use regression analysis. So, in order to use regression analysis, SPSS software was used that are effective and determinant features on performance and the features of number of seed per square meter and weight of 100 seeds.

RESULTS

Number of seed per square meter

Mycorrhizal treatment had significant difference over the number of seed per square meter, so that the level of inoculation of mycorrhizal had better performance than non-inoculation, which is due to symbiosis of fungus and root , and therefore more water absorption and nutrition and additive capacity in the plant. (Allen &Allen,1986). mycorrihizal is the main approach for symbiotic plants to gain low-movement nutritional elements (kouchaki et al,1377). Phosphate and vermicompost , separately caused increase of seed per square meter relative to control that can be due to phosphate dissolved microorganisms that include fungus and bacterium that causes release of phosphor from organic compounds (Ganeshwar et al ,2002) which has improved performance by assimilating more phosphor and increase of photosynthesis(figure 1&3). Shallan 14 in his studies on a herbal plant called borage suggested increase of performance components with more phosphor assimilation. By having useful practices likehigh porosity ,high absorption of nutritional elements, ventilation and drainage, and the capacity to hold water, vermicompost has caused better performance. Aziz *et al*, (1387) in a study suggested improvement in performance of chamomile plant that was due to vermicompost utilization.

Interaction of vermicompost and phosphate manure on features related to the number of seed caused improvement in performance (figure 4) so that increased number of seed per square meter relative to control to 133/8. This increase can be the result of high porosity of vermicompost, assimilation and maintenance of nutritional elements , suitable drainage and ventilation and increase in population of activity of useful microorganisms in soil in order to provide required nutritional elements like (phosphor) nitrogen and dissolved potassium.(Arancoon *et al*, 2004). Interaction of mycorrhizal with vermicompsot caused significant difference in the number of seeds(figure 5) but this difference was negative, *i.e.* level of inoculation with vermicompost relative to control caused decrease of performance to 89/6 seeds per square meter, that can be due to mycorrhizal factor (Lerat *et al*, 2003) interaction of mycorrihizal with phosphate manure, caused significant difference on the number of seeds, so that it had increase about 74 seeds per square meter relative to control but mean comparison diagram indicates that 60 kg per hectare of phosphate without presence of mycorrhizal fungus, had increase in performance, so that it caused increase in number of seed to 128 relative to control and 54 seeds per square meter relative to the level of mycorrhizal ×60 kg phosphate manure per hectare.(figure2). Interaction of either elements caused increase of the number of seed per square meter relative to control about 123 seeds.(figure6). Salehrastin 17(2001) in a study suggested that presence of biologic fertilizers cause fertility of soil and suitable provision of plant's required nutrition and therefore increase in performance. But by a short review of comparison diagram, it can be observed that level of non-inoculation of mycorrhizal with 10 tons per hectare of vermicompost and 60 kg per hectare of phosphate has the highest performance level about 217 seeds more than control and 94 seeds more than presence of either factors.

Weight of 100 seeds

Phosphate manure and mycorrhizal fungus separately caused significant difference in the weight of seed, so that this difference had increasing effect ,i.e. caused increase of the weight of 100 seeds, but vermicompost separately didn't cause significant increase (figure 7).

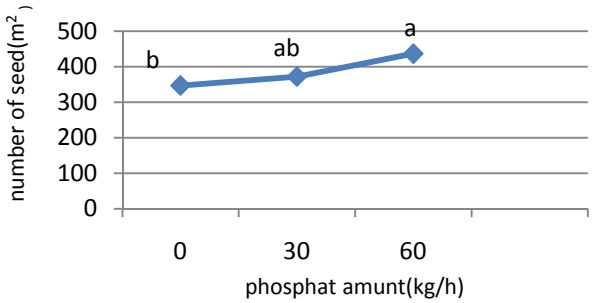

Fig. 1. Interaction phosphate amount on number of seed.

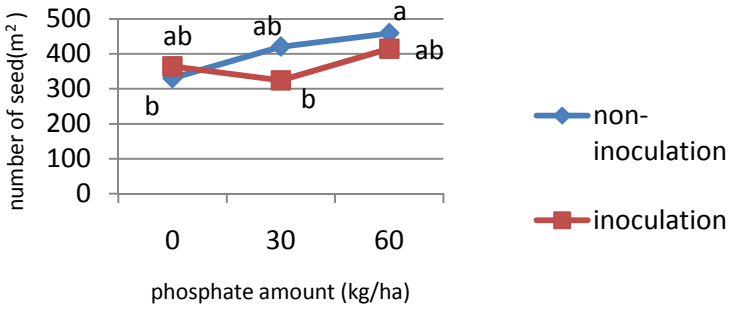

Fig. 2. Interaction between phosphate whit mycorrhizal on number of seed.

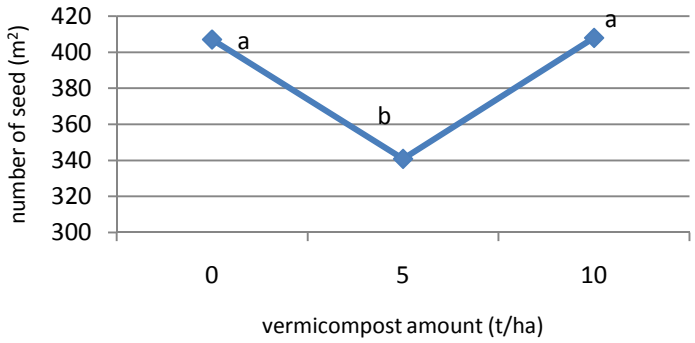

Fig. 3. Interaction vermicompost amount on number of seed.

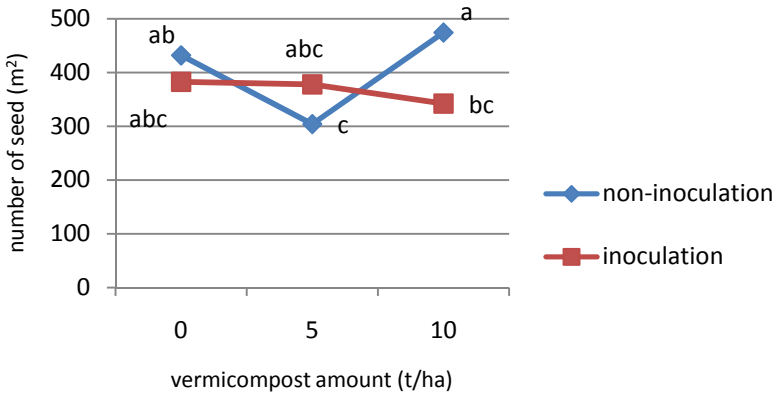

Fig. 4. Interaction vermicompost white mycorrhizal on number of seed.

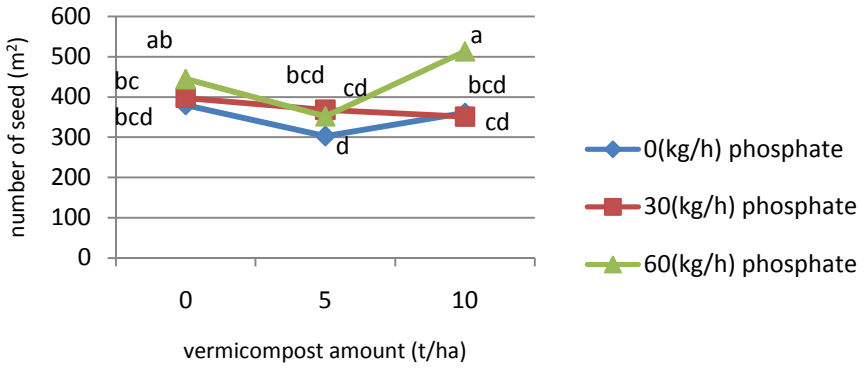

Fig. 5. Interaction phosphate whit vermicompost on number of seed.

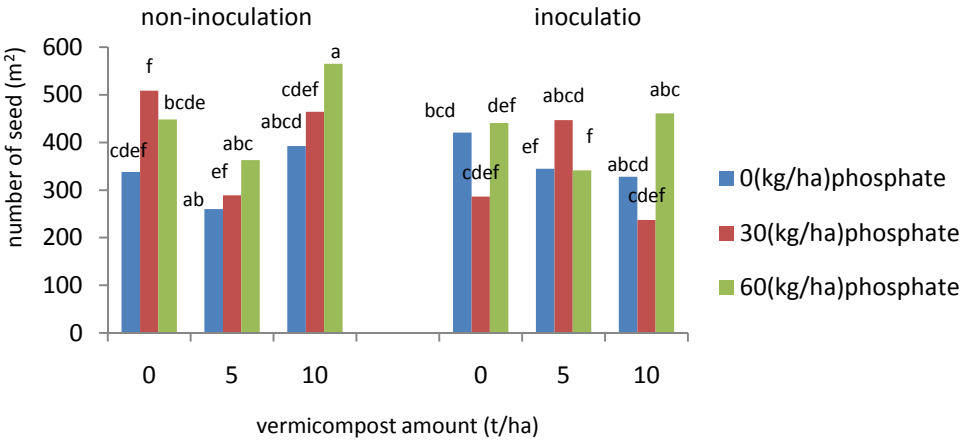

Fig. 6. Interaction phosphate and vermicompost whit mycorrhizal on number of seed.

Effect of mycorrhizal and phosphate manure caused increase to about 4/60 gr on the weight of 100 seeds, which is due to the fungus symbiosis and plant root, so that plant's roots assimilated better released ions of phosphor with the help of fungal hyphae.(salehrastin 18,2001). Interaction of phosphate manure and vermicompost caused increase of weight of 100 seeds like two previous effective features, so that this amount is about 3/52gr (figure 9). Utilization of vermicompost and mycorrhizal on the weight of 100 seeds caused increase of the weight of 100 seeds, that the highest increase relates to the level of 5 tons of vermicompost × mycorrhizal inoculation, which is about 1/81gr relative to control (figure 3). Utilization of either elements, inoculation of mycorrhizal × 30kg per hectare, phosphate manure × 5 tons per hectare of vermicompost caused increase of the weight of 100 seeds about 8/90gr relative to control (figure 11) that represents successful presence of either elements on increase of 100 seeds weight and there for increase of performance and is suitable in a sustainable agricultural system (Saleh Ratin,2001).

Seed performance

The mean data comparison indicates that there is a significant interaction among the levels of vermicompost , phosphate manure and mycorrhizal and their interaction together. The highest performance related to the 60kg level per hectare of phosphate× 10 tons in hectare of vermicompost × non-inoculation of mycorrhizal with 3433(kg per hectare). According to the diagram between the level of inoculation and non-inoculation ,mycorrhizal had higher performance level. Also 60kg per hectare of phosphate relative to two levels of 30 and 0 kg had higher performance.(figure 12). 10 tons of vermicompost also had better performance relative to 5 and 0 tons per hectare (figure 14) interaction of either factors together (presence of three factors) on inoculation of mycorrhizal × 60kg of phosphate per hectare× 10 tons per hectare of vermicompost with 2834 had higher performance relative to control that was about 2177 (kg per hectare) but in terms of performance, it has the fourth producing level.

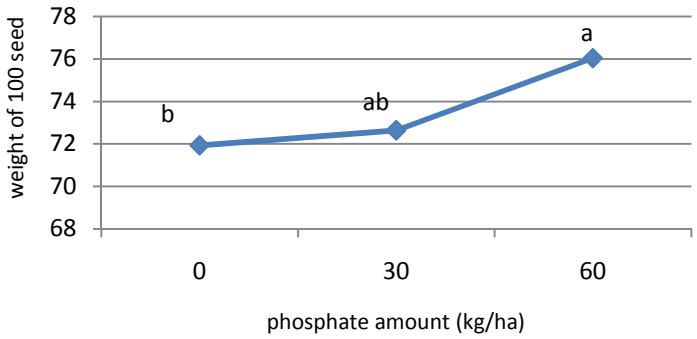

Fig. 7. Interaction phosphate on weight of 100 seed.

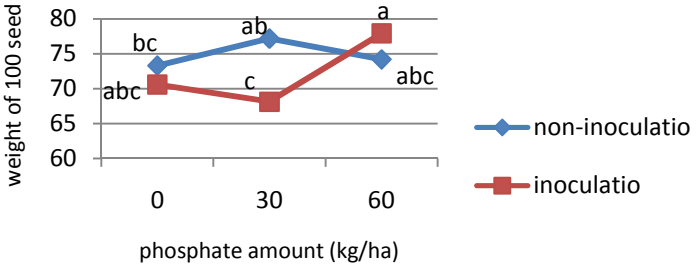

Fig. 8. Interaction phosphate whit mycorrhizal on weight of 100 seed.

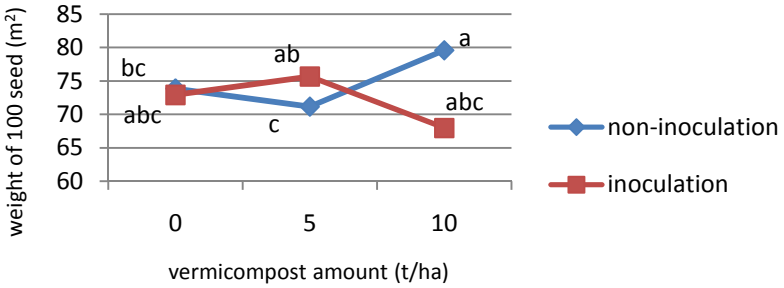

Fig. 9. Interaction vermicompost whit mycorrhizal on weight of 100 seed.

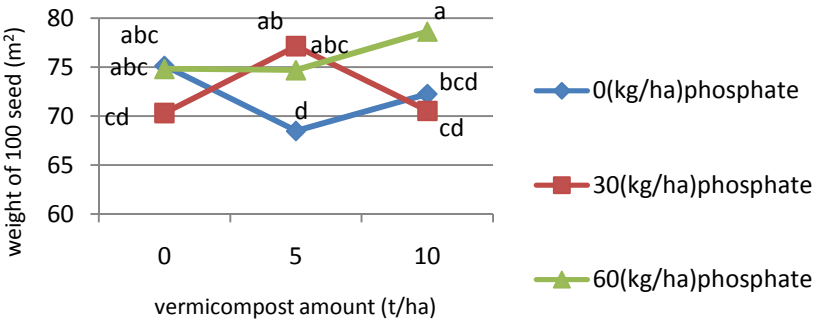

Fig. 10. Interaction vermicompost whit phosphate on weight of 100 seed.

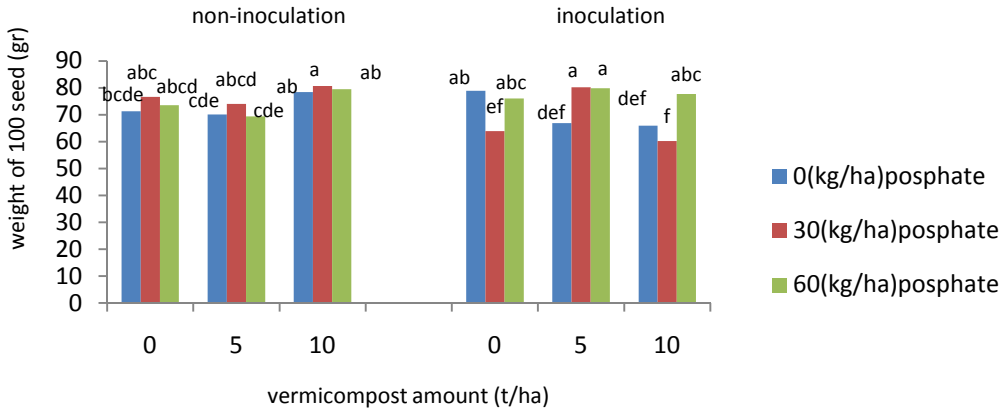

Fig. 11. Interaction vermicompost and phosphate whit mycorrhizal on weight of 100 seed.

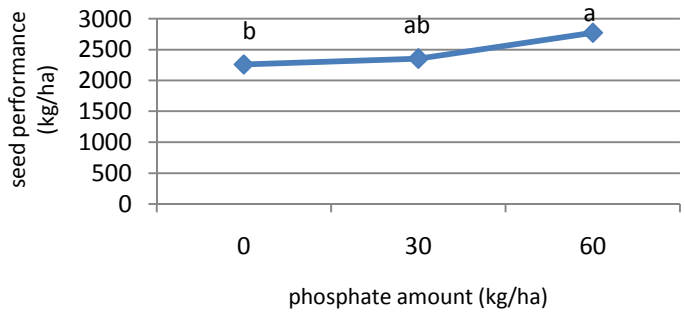

Fig. 12. Interaction phosphate on seed performance

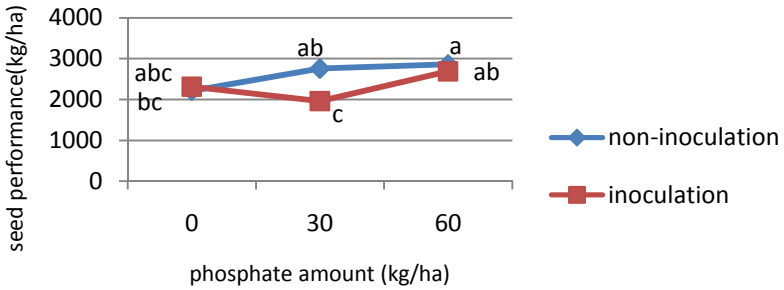

Fig. 13. Interaction phosphate whit mycorrhizal on seed performance

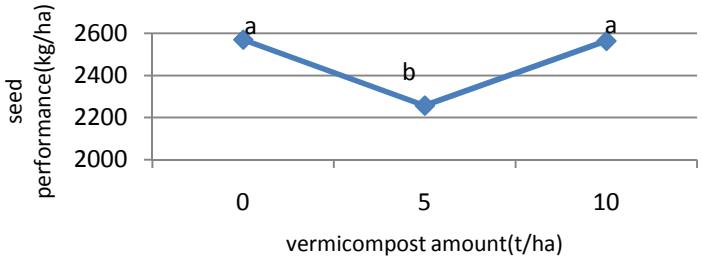

Fig. 14. Interaction vermicompost on seed performance.

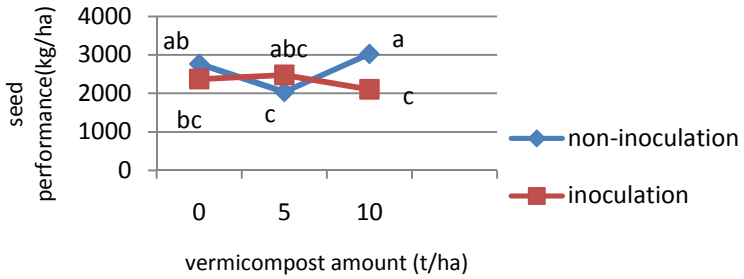

Fig. 15. Interaction vermicompost whit mycorrhizal on seed performance.

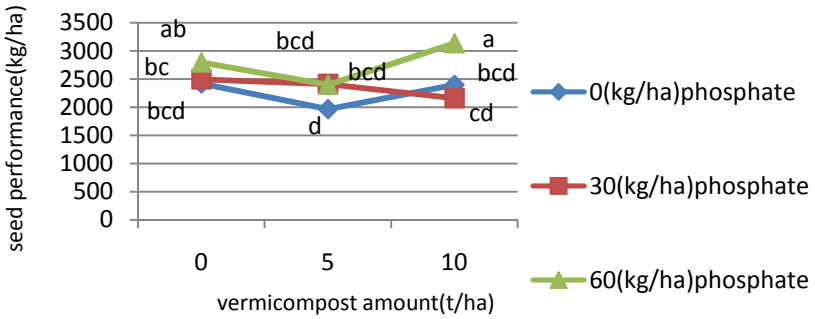

Fig. 16. Interaction vermicompost whit phosphate on seed performance.

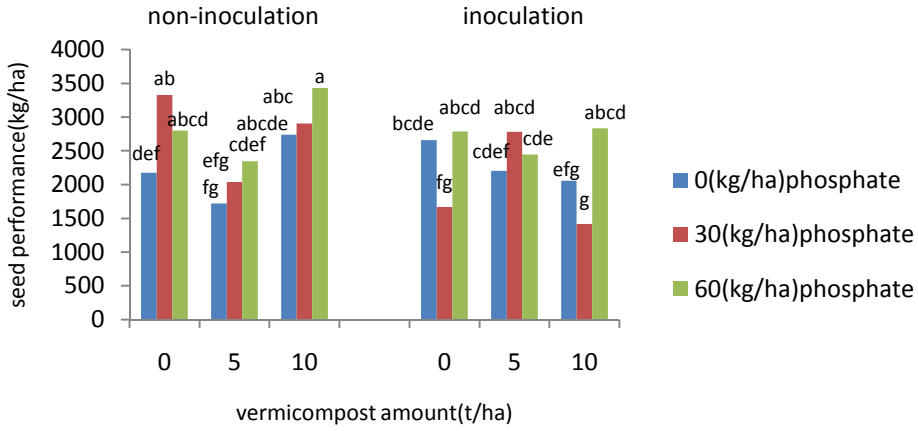

Fig. 17. Interaction vermicompost and phosphate whit mycorrhizal on seed performance.

CONCLUSIONS

According to the obtained results, using mycorrhizal fungus causes increase of functional components parameters especially effective feature on performance of seed, that finally , by increasing the growth of plant, it caused the increase of performance. Therefore its positive effect was evident in this research. Interaction of mycorrhiza and phosphate in 60kg level per hectare, caused increasing in most of the measurement parameters, especially parameters like number of seeds, and weight of seed 100 seeds, that they were finally important sources of performance.

Interaction of vermicompost and phosphate in most of the features especially effective features, had positive effect, that its best level, was 60 kg of phosphate × 10 tons per hectare of vermicmpost. Utilization of vermicompost and mycorrhizal in this research, did not indicate any positive effect, therefore using these two factors did not seem suitable in increasing performance and needs more examination. According to the results, it was observed that using biologic manures caused increase of performance of chemical fertilizers, especially phosphor in the level, and finally it caused improvement of performance.

So, we can say that utilized biologic fertilizers can be a suitable and a complementary object for chemical fertilizers and play an important role in decreasing chemical fertilizers.

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