

The Effect of natural organic manure on the growth and productivity of potato (*solanum tuberosum* L var spunta) in a Sahara desert region

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Abstract:

Many studies have been carried out on the growth, productivity and nutritional properties of potato, including the effects of organic manures on tuber yield and quality. However, there are few studies on the effect of organic manure on potatoes agriculture in arid zones. The main objective of this study was to investigate the effects of natural organic manure on the growth and productivity of potato (*Solanum tuberosum*, cv. Spunta) in a Saharian region (El-oued, Algeria). An experiment was laid out in a randomized complete block design (RCBD), with four replications and five labeled treatments, the control (no manure), the common fertilization treatment applied by the potatoes farmers 2 q/h (15-15-15 NPK) + 25 t/h poultry manure, 50 t/h of poultry manure, sheep manure and 50 t/h of mixed manure poultry and sheep 1:1 w/w. Results showed an increase in the foliage area, plant cover area and the number of stems per plants by adding poultry manure, and mixed manure more treatments of mixed manure (poultry and NPK) or sheep manure in comparison with control (no manure). The treatment by mixed manure showed significant increase in the number of tubers per plant in comparison with other treatments, but all the used treatments caused a significant increase in the tuber weights and the quantity of production and the percent of standard tubers in comparison with control. The treatments with poultry manure gave the highest yield in increasing the yield with high significant difference in comparison to other treatments. Thus, the combination of natural organic manures and low rates of inorganic fertilizers is a promising low cost option in the production of high yields of potatoes.

Keywords: Potato, Organic Fertilizer, Growth, yield.

Introduction

Potato (*Solanum tuberosum* L.) is one of the major crops contributing to the world of food requirements (Karam et al., 2009) produced by 130 nations (Snapp et al., 2003). Fertilizers are the most important inputs which increase the productivity and modern varieties of different crops (Anonymous, 1997; Ali et al., 2009). Fertilizer application has important effects on the quality and yield of potatoes (Leytem and Westermann, 2005). This latter is highly responsive to N fertilization and N is usually the most limiting essential nutrient for potatoes growth especially agriculture in sandy soils (Errebhi et al., 1998)

Limitation of source nutrients of plants can considerably reduce the growth of potato plant and the tuber yield so that that organic or inorganic manure. Mineral Nitrogen fertilization can increase shoot weights, leaf area, plant height and subsequently the total yield. While the application of excessive manure leads to immoderate growth, this effect can encourage competition between the source and sink, delayed maturity and subsequently can reduce the tuber yield (Hay et al. 1989). In addition, excess nitrogen has a negative effect on tuber quality and environment (Goffart et al. 2008)

Organic fertilizers such as cattle manure and chicken manure contain a large amount of nutrients that influences plant growth and production via improving chemical, physical and biological fertility (Winterhalder et al. 1974). Other researches showed that LAI, shoot weights, plant height and tuber yield can be increased by application of organic fertilization (Stoner et al. 1996)

Application of organic fertilizers is one of the important practical measures to improve soil fertility. In addition to providing necessary nutrients for crops and improving soil physico-chemical properties, organic fertilizer is able to enhance soil microbial activity of soil, such as improving activity of soil enzymes and increasing soil microbial biomass (Ren et al. 1996; Sun 2003; Lv et al. 2005).

The purpose of this investigation was to determine changes in morphological and productivity characters

Method and material

chemical analysis Soil sampling and manure organic

A sand soil collected from Hassi kalifa and Zoogbiat towns was used in this study prior to commencement of experiment in surface (0-20 cm depth). Soil samples were taken randomly and manure was applied by brushless manure organic before plowing and prose fertilizer chemical.

land preparation and treatment :

The experiment included five treatments with four replications and fully-randomized arrangements. There were five treatments replicated four times and five plants on each block measuring 1.5 x 3m (ie 4.5 m²) with a 1 m gap between plants and between blocks (figure 1). A flat tilled land surface was made to define the experimented plants. The total land area used was 200m².

The Organic manure (poultry chicken and sheep) and inorganic fertilizer N P K (15 15 15) were used and included :

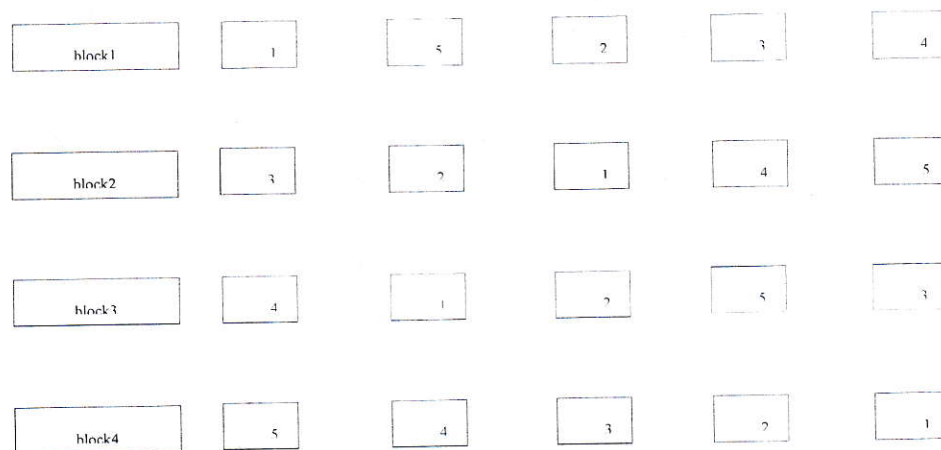


figure 1.The experiment Design

A; no manure used (control)

B: N P K 2 qu /h + 25 t /h chicken manure(the common fertilization treatment applied by the potato farmers)

C: 50 t/ h chicken manure

D: 50 t/ h sheep manure

E: a mixed manure 25 t/h of poultry chicken manure and 25 t /h sheep manure.

Table (1) some chemical and physical properties of soil and animals manures used in the experimental soils.

	Soil Structure			chemical and physical				
	Sand	silt	clay	PH	CE	N	P	K
soil	97.2	2.8	0	7.2	4.2	28	31.2	130.3
sheep manure	/	/	/	8.5	2.1	1.9	0.75	3.1
chicken manure	/	/	/	8.8	2.6	3	2.7	2.3

Plant material

We used in this research plant potatoes(variety Spunta) from the production company AGRICO,

Determination of growth and yield parameters

five plants were randomly selected at the center of each plot five weeks and ten weeks after sowing.

For data collection, plant height and leaf area per plant were determined 38 ;70 days after sowing

The tuber weight of the plant was determined and the yield was calculated per hectare and percent of stander tuber.

Statistical analysis.

The analysis of variance ANOVA procedure was carried out to determine the difference in parameter. Mean values were compared using the least significant difference (LSD) at 0.05 level of probability

Résultats et discussion :

soil chemical properties

Basic properties of main organic fertilizers and the experimental soil were shown in Table 1. The soil of the sites was sandy and Soil pH was neutral 7.02. The total N content was 62.54ppm(0.062 g/kg) represents a deficiency and considering the 150- 200 ppm (0.15-0.20g/kg) critical level by Sobulo and Osiname,1981 (Sherifat, 2010) while the K total were 51.05 ppm represents a deficiency end considering the 300ppm as being critical for sustainable crop production (Ayodele., 1984; Adeoye and Agboola., 1985). The free of P was required relatively in large amounts of manures de la flore végétale.

Effect of organic nature manure in leaves area

The results table (2) showed a significant difference in leaves area amongst treatment and its increase as compared to the control .

The leaves area was significantly higher in plants derived from chicken manure and the common fertilization treated plots and lower in plants derived from chicken manure on first growing period.

whereas, in the second growing period the chicken manure gave more leaves area on other all treatments and also the results showed increase in the leaves area in all treatments. The growth speed was 0.72 cm² /d in comparison with other treatments.

This result was in accordance with observation of Hamedan (2006) and Al-Balikh (2008)

The results showed an increase cover area plants significantly in chicken manure and mixed manure as compared with other treatments and the treatments of the common fertilization, sheep manure increased significantly as compared with the control . The results obtained from the experiment on number of leaves plant was conformity with Vimala, (2006).This results showed in the table 02 increase significantly the numbers stems for treatments (the common fertilization, sheep manure, mixed manure chicken and sheep 1:1 w/w) as compared with the control wich is in accordance with observation of Ayoola and Makinde (2007) and Al-Balikh (2008). It showed that stems length is increasing in all treatments to day 70 of planting date. Which is the last period of vegetative growth.

It also showed significantly all manure treatments in plants height as compared with the control .yet, chicken manure and mixed manure application had significant increase for the common fertilization and sheep manure.

This result signifies the marked contribution of manure to growth . The main effect of chicken manure was highly significant (0.4cm/ day) But, This finding is in accordance with observation of Adeyemi et al. (1987); Ajari et al., 2003) and it increased the plant height of amaranthus. Also, Tindall (1975). The organic fertilizer has slow nutrient release capacity that caused lower plant height. Results under the present experiment on plant height was supported by Souza et al. (2008).

effect of organic nature manure in productivity

The results presented in Table03 have demonstrated that productive increase varies according to the kinds of organic manures added .

results reveal that the highest mean values of tuber weight were recorded in case of the chicken manure . On the other hand, the lowest values were obtained in case of sheep manure whereas, the same trend was observed in control treatment . The significant values of production gram per meter cube or grams per plant (g/ m² or g/plant) was observed when all treatments of fertilizers compared to control treatment .

the highest significant values were obtained in yield g/ m² when plants treated with chicken manure or mixed manure chicken and sheep 1:1 w /w compared to other treatments.

The percentage yield increase over the control ranged from 74.12 to 191.2 The lowest percent increase (74.12%) obtained from sheep manure treatment and the highest percentage yield increase (191.2%) was obtained from chicken manure treatment followed by chicken manure treatment with sheep manure and the common fertilization. Also the results showed increase in the percentage production of standard tuber for both treatments as compared to the control treatment. That was varied according to the manure kind.

Results reveal that the highest Standard proportion of tubers were recorded in treatment the chicken manure only (96.26 %), then it is followed by the treatment of mixed manure chicken and sheep (95.90 %) .then respectively treatments of sheep manure (93.53 %) , treatment of chicken manure with NPK fertilize (92.27 %)and the control Treatment (88.60%).

These results indicate that poultry manure or chicken manure mixed with fertilizer sheep provides that plant greatly benefit from the nutrients leading to increased production and quality (increase the size of tubers). These results are compatible with the research Darojkina 1972 proved that we can get the same production when adding quantities of organic fertilizers. An alternative source of nutrients in mineral fertilizers was evident in the two treatments T2 and T4 also in accordance with fedotova result, (2002) which present increase in the percentage of production of standard tuber increased by application of organic manure and inorganic. with observation of Al-Balikh 2008 organic chicken manure resulted in highest values of number of tubers/plant, total tuber yield/ha, and marketable tuber yield/ha

These results are in agreement with those obtained by Tsyganov et al. (2000) , Ferreira and Goncalves (2007) with observation of Al sahaf and Atee,(2007) . Havlin et al ,(2005) . Adediran et al ,(2004) . zidan ,(2005) which presented that fertilizer is one of the most important inputs of increasing the productivity of crops plants

Table 2 effect of organic nature manure in growth parameters

treatment	leaves area cm ² /plant		cover area plants m ²		plants height		number stem
	38 days	70 days	40 days	70 days	38 days cm	70 days cm	
T1	5.8	13.65	0.031	0.084	6.14	10.60	1.5
2 T	10.5	23.25	0.061	0.187	8.28	14.27	2.5
3 T	7.6	20.25	0.037	0.136	9.54	11.14	2.4

4 T	9.8	31.30	0.106	0.338	16.7	31.72	3.64
5 T	7.9	23.14	0.101	0.281	15.13	24.95	3.5
LSD	2.48	4.23	0.02	0.177	2.55	5.30	0.67
C.V%	19.41	12.31	19	55.92	13.14	17.72	31

Table 3; the effect of organic nature manure in yield and productivity

treatment	number of tubers per plant	the percent of standard tuber	productivity g/ m ²	productivity g/plant	percent production on control	the percent production of standard tuber
T1	4.33	61.45	2352.6	294.07	100	88.60
2 T	6.46	72.83	4740.3	592.53	201.49	92.27
3 T	6.36	69.80	4096.37	512.05	174.12	93.53
4 T	6.66	76.62	6850.8	856.35	291.2	96.26
5 T	7.97	80.84	6738.7	842.31	286.43	95.90
LSD	1.13	-	817.56	102.2	-	-
C.V%	11.95	-	10.7	10.7	-	-

Conclusion

The effect of animal manure sources on the yield of potato given in table 3 .The application of animal manure sources showed a significantly higher (p 0.05) yield of potato over the control. However; poultry manure application gave the highest potato yield followed by mixed manure and the common fertilization and then sheep manure

The numbers of tuber per plant and tuber weight are important yield determining factors and reflect the extent of tuber development. These yield components were also significantly influenced by the fertilizer treatments.

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