INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 5, No. 1, p. 120-126, 2014

RESEARCH PAPER OPEN ACCESS

Inoculation effect of phosphate fertilizer 2 under different levels of nitrogen and phosphorus fertilization on quantitative traits roselle (*Hibiscus Sabdariffa* L.)

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Key words: Nitrogen, roselle, phosphor.

http://dx.doi.org/10.12692/ijb/5.1.120-126 Article published on July 02, 2014

Abstract

Roselle (Hibiscus sabdarjffa L.) belongs to the malvaceae family, and is an annual or biennial plant cultivated for its stem, fiber, edible calyces, leaves and seeds. Environmental problems caused by irregular application of chemical fertilizers, inappropriate energy production methods and excessive consumption costs have all had harmful effects on biological cycles and destroyed farming stability systems; these factors altogether encourage the application of bio ferti-lizers. The field experiment was laid out in randomized complete block design with factorial design with three replications. Factor a consisted of phosphate fertilizer 2 (a1: with inoculation, a2: without inoculation), Factor b consisted of Nitrogen (b1: without N, b2: 100 kg/ha, b3: 150kg/ha), Factor c consisted of phosphor (c1: without p, c2: 100 kg/ha, c3: 150 kg/ha). The variance analysis of the studied traits showed a significant ($p < 0.01$) effect of Phosphorus, Nitrogen and Phosphate fertilization2 on Number of bolls per plant, Weight of bolls per plant, Boll weight per plot and Sepals of a boll weight. So that the greatest number of bolls per plant at a rate of 84.33 in the treatment inoculated respectively. So rate to the highest boll weight to 391.19g in treatment inoculated, respectively.

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Introduction

Roselle (*Hibiscus sabdariffa* L.) belongs to the malvaceae family, and is an annual or biennial plant cultivated for its stem, fiber, edible calyces, leaves and seeds (Rao, 1996). The crop is used in a variety of ways for home consumption, medicinal and industrial uses. The crop is however most suited for tropical climate with high humidity and temperature of about 25°C to 35°C (Hacket and Carolene, 1982). The plant requires an optimum PH of 6-7 and rainfall of about 450-500mm which should be well distributed over 90-120 days during the growing season (Morton, 1987). It can tolerate relatively high temperature throughout the growing and fruiting periods. The plant requires an optimum rainfall of approximately 45 – 50 cm distributed over a 90 - 120 day growing period (Tindal, 1986). The leaves and calyx of the green variety are very rich in vitamin C, β-carotene and riboflavin with some major mineral elements (Babalola, 2000). Environmental problems caused by irregular application of chemical fertilizers, inappropriate energy production methods and excessive consumption costs have all had harmful effects on biological cycles and destroyed farming stability systems; these factors altogether encourage the application of bio fertilizers (Kannayan, 2002). Nowadays attention to biological fertilizer has been increased due to countries development, prices of chemical fertilizers and attention to sustainable agricultural systems (Ehteshami *et al.*, 2007). Biological phosphate fertilizers containing beneficial bacteria and fungi increased phosphate solutions by increasing soil acidity or alkaline phosphatase enzyme, which can be absorbed by plants easily. Soil chemical and biological characteristics improved by bio fertilizer; moreover due to the use of low doses of chemical fertilizers, agricultural production will be free from contaminants (EL- Habbasha *et al.*, 2007; Salimpour *et al*; 2010). Furthermore, application of biological fertilizer increased plant height by increasing plant growth regulator hormones production (such as IAA and GA) (Senthil-Kumar *et al.*, 2009). Nitrogen is an element limiting plant growth in many ecosystems; efficient use of nitrogen is believed to contribute to the fitness of the plant. Moreover, the nitrogen availability and internal distribution plays a critical role in the regulation of various growth-related and morphogenetic aspects of plant development that are usually attributed to hormonal factors (McIntyre, 2001; Hikosaka, 2004). The amount of nitrogen applied to plants must be carefully managed to ensure that N will be available throughout the growing season, and vegetative and reproductive development will not be restricted (Vidal *et al.*, 1999). The purpose of this article evaluation of phosphate fertilizer 2 under different levels of nitrogen and phosphorus fertilization on Number of bolls per plant, Weight of bolls, Sepals of a boll weight and Fresh weight. Motivation and aims of the study were effect of phosphate fertilizer 2 under different levels of nitrogen and phosphorus fertilization on quantitative traits Roselle.

Materials and methods

Location of experiment

The experiment was conducted at the Zahedan Lvaryab (in Iran) which is situated between 60° North latitude and 30° East longitude.

Composite soil sampling

Composite soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics.

Field experiment

The field experiment was laid out in randomized complete block design with factorial design with three replications. Factor a consisted of phosphate fertilizer 2 (a1: with inoculation, a2: without inoculation), Factor b consisted of Nitrogen (b1: without N, b2: 100 kg/ha, b3: 150kg/ha), Factor c consisted of phosphor (c1: without p, c2: 100 kg/ha, c3: 150 kg/ha). 4-5 seeds of roselle were sown on plots consisting of six ridges, 75cm apart and 6m long at a spacing of 60 cm apart (intra-row spacing). After crop establishment, the plants were thinned to 2 plants per stand. Calyces from each were harvested from the four inner rows (net plot) of each plot. The value obtained was converted to per hectare basis. The seedlings were

watered twice daily (morning and evening) using watering can and weeded regularly. The experimental area and the surroundings were kept clean to prevent harbouring of pest. The pots were lifted from time to time to prevent the roots of the plants from growing out of the container.

Control of insects

Insects were controlled using Sherpa plus (Saro Agro Sciences) four weeks after planting at the rate of 5 ml per 5 liters of water.

Data collect

Data collected were subjected to statistical analysis by using a computer program MSTATC (Freed and Scott, 1986). Least Significant Difference test (LSD) at 5 % probability level was applied to compare the differences among treatments` means.

Results and discussion

Number of bolls per plant

Analysis of variance showed that the effect of phosphate on the number of bolls per plant, fertilize 2 was very meaningful (Table 2).

Table 1. Soil characteristics of the experiment during 2012 area growing season.

Year	Depth of soil (cm)	pH	Ec(ds /m)	N (%)	Ca(ppm)	K(ppm)
2012	0-30	7.98	4.4	0.036	11.4	97.6

So that the greatest number of bolls per plant at a rate of 84.33 in the treatment inoculated respectively. The increase in plant growth and umbels of fennel were reported following the use of bio fertilizers showed that the application of fertilizers to the lack of fertilizer caused a significant advantage (Azzaz, 2009; Badyan &Safwat, 2004). Effect of nitrogen on number of bolls per plant was significant at the five percent means (Table 2). so that the greatest number of bolls per plant (83.83) was observed at 150 kg per hectare compared with the number in the 50 kg ha (64.83) was higher (Table 3). Nitrogen increases the number of flowers per plant and weight of oil significantly increased the level of nitrogen fertilizer. Increased levels of nitrogen fertilizer to promote the growth of shoots and flowers leads and ultimately will lead to increased dry matter accumulation (Letchamo, 1993; franzand kirsch,1974). Number of bolls per plant was strongly influenced by phosphorus, to investigation conducted so that the greatest number of bolls per plant (104.16) was observed at 100 kg P ha (Table 3). Sufficient number of tumors formed by phosphorus and nitrogen fixing of peanut increased (Stancheva *et al*,1992).

Table 2. Hibiscus tea variance decomposition characteristics affect levels of nitrogen, phosphorus and phosphate fertilized 2.

S.O.V	d.f	Number of bolls per plant	Weight of bolls per plant	boll weight per plot	Sepals of a boll weight	Fresh weight per plant
R	2	111.46^{ns}	3.66^{ns}	340.66^{ns}	0.45^{ns}	194866.66^{ns}
Nitrogen (A)	2	1725.90^{*}	36.07^{**}	34960.05^{**}	12.80^{**}	450072.22^{**}
Phosphorus (B)	2	13885.68^{**}	27.61^{**}	160182.16^{**}	8.54^{**}	1892601.38^{**}
Phosphate fertilization2(c)	1	6981.40^{**}	12.08^{*}	110794.74^{**}	4.16^{*}	542001.85^{*}
A*B	4	1555.60^{**}	0.90^{ns}	184042.72^{**}	0.41^{ns}	863940.27^{**}
B*C	2	889.12^{ns}	2.40^{ns}	34590.24^{**}	0.41^{ns}	140557.40^{ns}
A*C	2	1667.46^{*}	0.91^{ns}	9395.79^{ns}	0.32^{ns}	1822528.24^{**}
A*B*C	4	3141.76^{**}	3.01^{ns}	145592.12^{**}	0.85^{ns}	1231725.46^{**}
Error	34	330.69	2.22	4876.39	0.60	82538.72
C.V (%)	-	24.92	14.62	20.18	14.81	24.63

* and **: significant at 5% and 1% probability levels, respectively.

ns: Not significant غیر معنی دار :ns

Weight of bolls per plant

Analysis of variance showed that the effect of phosphate fertilization 2 on a boll weight per plant was significant at 5% level means (Table 2). so that the maximum weight of bolls per plant, the amount of 10.66 mg treatment were inoculated (Table 3). Inoculation of maize biological fertilizer plant dry weight increased, because it will improve their access to and uptake of nutrients listed and stated that the issue of the dry matter of maize has increased (Stancheva *et al*, 1992). Nitrogen effect on the weight of bolls per plant, mean % probability level was significant (Table 2). so that the maximum weight of bolls per plant (11.53 g) was observed at 150 kg per hectare in comparison weighs 50 kilograms per hectare (8.71 g, respectively) (Table 3). A number of researchers have demonstrated that increased levels of nitrogen fertilizer to promote the growth of shoots and flowers and eventually leads to the increase of dry matter accumulation (Letchamo1993, Franz and Kirsch1974). A boll weight per plant was affected by P, the so survey conducted at the highest boll weight per plant (11.47 g) was observed at 100 kg P ha. It has been shown that P increases carbohydrates, soluble sugars and mineral composition of the shoots, flowers and roots are German chamomile (Ablah *et al*, 2004).

Table 3. Hibiscus tea features mean ¬ influenced by levels of nitrogen, phosphorus and phosphate fertilized 2.

Treatments	Number of bolls per plant	Weight of bolls per plant	boll weight per plot	Sepals of a boll weight	Fresh weight per plant
Nitrogen					
50kg/ha	64.83b	8.71c	302.50b	4.37c	1039.44b
100kg/ha	70.22b	10.34b	344.56ab	5.30b	1115.56b
150kg/ha	83.83a	11.53a	390.61a	6.05a	1343.33a
phosphor					
0kg/ha	50.94c	9.00c	237.83b	4.55c	906.94b
50kg/ha	63.77b	10.10b	388.00a	5.24b	1061.67b
100kg/ha	104.16a	11.47a	411.83a	5.93a	1529.72a
Phosphate fertilized 2					
With inoculated	84.33a	10.66a	391.19a	5.52a	1266.30a
Non- inoculated	61.59b	9.72b	300.59b	4.96b	1065.93b

Means in each column follow by similar letter(s) are not significantly different at 5% probability level, using Duncan's Multiple Range Test.

Boll weight per plot

Analysis of variance showed that the effect of phosphate fertilization on boll weight 2 was highly significant in each plot. (Table 2). So rate to the highest boll weight to 391.19g in treatment inoculated, respectively. (Table 3). Inoculation of maize biological fertilizer plant dry weight increased, because it will improve their access to and uptake of nutrients listed and stated that the issue of the dry matter of maize has increased (Stancheva *et al*, 1992). Nitrogen effect on boll weight per plot was significant at the one percent level of probability (Table 2). The so the highest boll weight (390.61 g) was observed at 150 kg per hectare in comparison weighs 50 kilograms per hectare (302.50 g) was higher (Table 3). Car herb scented geranium study concluded that overall nitrogen uptake significantly increased with the application of 160 kg nitrogen per hectare increased (Ram *et al*., 2003). In addition to the increased use of nitrogen fertilizer increased plant tissue nitrogen, total yield of dry matter per acre increase. Which in turn led to an increase in nitrogen uptake? Boll weight per plot was influenced by phosphorus, was significant at the 1% level. The so conducted the reviews highest boll weight (83.411 g) was observed at 100 kg P ha. Application of phosphate fertilizers can have a significant impact on

the amount of flowering and seeding of herbs has (Najafpour, 2001).

Sepals of a boll weight

Analysis of variance showed that the effect of phosphate fertilization 2 sepals of a boll weight 5% level was significant (Table 2). So that the maximum amount of weight the sepals 5.52 g were inoculated treatments (Table 3). Results of bio-fertilizer phosphate compared with triple superphosphate fertilizers on corn, soybeans and wheat, fertilizer, confirming the satisfactory effect, so that it was clear that a significant increase compared with bio-fertilizer phosphate to yield (Jat and Shaktawat,2003). Effect of nitrogen on the sepals of a boll weight in probability level means was significant (Table 2). So that most of the sepals of a boll weight (6.05 g) was observed at 150 kg per hectare in comparison weighs 50 kilograms per hectare (4.37 g, respectively). The report determined that nitrogen fertilizer, not only on performance alone was effective chamomile. But in combination with low concentrations of plant hormones, flower yield and essential oil percentage increased Kamazolin (Meawad *et al*,1984). Sepals of a boll weight was affected by P, the so survey conducted in the leaflet greatest weight (5.93 g) was observed at 100 kg P ha. It has been shown that P increases carbohydrates, soluble sugars and mineral composition of the shoots, flowers and roots are German chamomile (Ablah *et al*, 2004). Analysis of variance showed that the effect of phosphate fertilization 2 on fresh weight yield at 5% means was significant (Table 2). so that the maximum amount of weight (1266.30 gr) were inoculated treatment. The tests showed that the use of phosphate fertilizer on plant biology, fennel significant effect on the number of umbels per plant, seed weight, harvest index and grain yield did not affect plant height and biological yield was significant (Darzi, 2006). Nitrogen effect on plant fresh weight per probability level means was significant (Table 2). So that the highest fresh weight (1343.33 gr) was observed at 150 kg per hectare in comparison weighs 50 kilograms per hectare (1039.44 gr) were higher (Table 3). Low levels of nitrogen in crop and weed development of less developed due to light absorption and greater excellence and high levels of nitrogen for crop growth and ghosting weed suppression has been (Jomsgard *et al*, 1996). Fresh weight per plant at 1% level of phosphorus was affected by the so survey conducted at the highest fresh weight (1529.72 mg) per 100 kg P ha (Table 3). Inorganic phosphorus of the most important elements in improving the yield and quality of medicinal plants are considered. So that the availability of these elements can have a significant impact on the ultimate performance of these plants (Tuncturk and yildirim 2001).

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