East African Scholars Journal of Agriculture and Life Sciences
Abbreviated Key Title: East African Scholars J Agri Life Sci
ISSN 2617-4472 (Print) | ISSN 2617-7277 (Online) |
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-2 | Issue-10 | Oct-2019 |

Research Article

The Effect of Rhizobium Bacteria, Vitamin B12 and the Two Elements Boron and Molybdenum on the Characteristic Morphology of Pea Plant

A.M.EL-Mahmoudy[1*], Ahlam[1] Rashed, Khalifa[2] S. Mohamed, Nouri[1] Kushlaf, Lubnah[1] Eljade, Seham[3] T. M. Oshkondali[3]

[1]Faculty of Science /Zawia University, Libya
[2]Faculty of Science /Gharyan University, Libya
[3]Faculty of Medicine / Zawia University, Libya

*Corresponding Author
A.M.EL-Mahmoudy

Abstract: A field experiment was conducted to study the effect of pea seeds pollination with Rhizobium bacteria and spraying with vitamin B12, molybdenum and boron, as well as their mutual effect on vegetative growth characteristics, wet and dry weights. Where the two treatments protocol by using (Rh + B12, Rh + Mo, and Rh. B) were used, respectively. The results revealed that, the highest values were recorded in vegetative growth traits (plant height, number of leaves, wet weight, and dry weight) in comparison with the control.

Keywords: Rhizobium bacteria and spraying, vitamin B12, molybdenum and boron, (plant height, number of leaves, wet weight, and dry weight).

INTRODUCTION:

The element boron is important and effective in the formation of bacterial nodes. As well as the element molybdenum besides iron enter in the synthesis of the enzyme nitrogenase which is responsible on the stabilization of atmospheric nitrogen. In addition, the speed of nitrogen plant absorption can be increased by increasing the supply of elemental molybdenum, and notice that a significant increase in the concentration of this element in the bacterial nodules compared with other plant tissues (Tubil, 1989). In addition, molybdenum is involved in the synthesis of the enzyme Nitrate reductase which responsible on the reduction of nitrate ions (-N03) to nitrite ions (-NO2) during photosynthesis process (kandel *et al.*, 2013). Vitamin B12 helps in the construction of tissues and also helps in the formation of bacterial nodes in the plant (Sierra *et al.*, 1999). Root ganglia have a key role in the photosynthesis process and stabilization of atmospheric nitrogen. Also root ganglia responsible on the penetration of the root cells by the atmospheric nitrogen and formation of many sugars, which in general represent root formation factors (William *et al*., 2003). The presence of Rhizobium bacteria on the roots of pea plants can increase bacterial nodes and their weight, root weight, branches weight, pod yield, seed yield and roots nitrogen content (Talukder *et al.*, 2008 & Ali *et al*,. 2008). A study has been done to determine the effect of pollination and bio fertilization with Rhizobium approved that, yield productivity was increased and more effective when nitrogen was added to pea seeds with bio-fertilization (Zaja *et al.*, 2013). El-Hamdaoui *et al*., (2003) found that boron and calcium were necessary for the formation of bacterial nodes on pea plants, as well as on their development and growth even under salinity conditions. Molybdenum is a catalyst and a cofactor for nitrogenase enzyme which required for nitrate reduction. When it was sprayed, it has a positive effect on increasing the number of nodes, as well as the dry weight of the pea plant. In addition, spraying with molybdenum increasing the weight of pea pods and nutrient content, as well as the formation of bacterial nodes (Hristozkova *et al.*, 2006 and 2005, Gad, 2012.Gad and Abd El-Moez, 2013). Mahmoud *et al.*, (2011) found that the addition of boron to pea plants with pollination of seeds by Rhizobium gave an increase in the number of bacterial nodes by using a low concentrations, while high concentrations had a toxic effect. Moreover, the spraying of boron pea plants in the form of Borax increased the yield of pods by 37% compared with the comparison treatment. (sharma, 2016).

Quick Response Code

Journal homepage:
http://www.easpublisher.com/easjals/

Article History
Received: 15.09.2019
Accepted: 26.09.2019
Published: 16.10.2019

MATERIALS AND METHODS:

A field experiment was conducted in a farm in Sabratha city, about 1.5 km west the city center by planting pea seeds to produce green pods from one of the common cultivars in the Libyan land class (Progress. No. 9). Where it treated with Rhizobiume, molybdenum, boron, vitamin B12.The vegetative growth characteristics were studied at 6 weeks of planting. Data obtained were analyzed by Snedecor and Cochran (1980) and the mean parameters of the studied traits were compared with the least significant difference (LSD) at a significant level (0.05%).

Table 1: Effect of Rhizobium, Molybdenum, Boron, Vitamin B12 and their Mutual Effect on Vegetative Growth Characteristics of Pea Plants.

Treatment	Length of plant (cm)	Number of branches	Number of papers
Control	8.4 d	1	5.10 h
$V.B_{12}$	8.50 d	1	5.20 g
Mo	10.93 c	1	5.76 f
Rh+Mo+B	12.53 ab	1	5.76 f
B	11.36 c	1	6.10 e
Rhizobium	11.86 c	1	6.10 e
Rh+Mo+B+V.B12	12.16 c	1	6.10 e
B+VB12	11.93 c	1	6.43 d
Mo+V.B12	11.96 c	1	6.60 c
Mo+B	13.23 ab	1	6.76 c
Rh+B	13.53 ab	1	7.00 b
Rh+Mo	14.16 ab	1	7.10 b
$Rh+V.B_{12}$	16.60 a	1	7.43 a
LSD(0.05)	3.99	NS	0.09

RESULTS AND DISCUSSION:

Table 1 shows that the most effective treatment on plant length and number of leaves is Rh + V.B12 (16.10 cm-7.43), followed by Rh + Mo (14.16 cm-7.10) and Rh + B (13.23 cm - 6.76), respectively, whereas the number of branches did not have been affected. This can explain the importance of both the presence of pollination with Rhizobiume and spraying with vitamin B12, as well as using the two elements boron and molybdenum. The vaccination with bacteria Rhizobium lguminosarum increases the characteristics of vegetative growth due to the symbiotic relationship between legumes roots and Rhizobiume bacteria (Subba Rao, 1984). Moreover, due to the role of vitamin B12 in the formation of bacterial nodes, stabilization of atmospheric nitrogen, and increasing the protein formation inside the cells, that could improve the characteristics of vegetative growth of plant length, and the number of leaves (Subba Rao, 1986). Molybdenum is also an important factor in the activation of Rhizobium bacteria to carry out its vital functions and in stabilizing atmospheric nitrogen. It also plays an important role in the conversion of nitrates to ammonia inside the cell which prepares the cell for amino acids and proteins construction (Tubil, 1989). As well as, the boron element has an important role in the formation of root nodes in legume plants, and also in the hormone formation and fat metabolism, also it helps Rhizobium bacteria to perform itis vital role in the stabilization of atmospheric nitrogen which important in the formation of nucleic acids and transportation of sugars and organic acids through the plant cell membrane (Mengel and Kirkby, 1982). These results are consistent with Talukder *et al*., (2008), (Hewedy and Gad, 2011) and (Gad and Abd El-Moez, 2013).

The different treatments with the Rhizobium and the two elements boron and molybdenum and vitamin B12, and their mutual effect on each other significantly affect the dry and wet weights of peas plants, while the treatment with (Rh + V.B12) (36.96 g-52.03 g) was the most effective in giving an increase in wet and dry weights, followed by treatment (Rh + Mo) (45.20 g-33.80 g) and treatment (Rh + B) (45.00 g - 33.76 g) respectively (Table 2).

Table 2: Effect of Rhizobiume, Molybdenum, Boron, Vitamin B12 and their Mutual Effect on Wet and Dry Weights of Pea Plants.

Treatment	Fresh weight of plant (g)	Dry weight of plant (g)
Rhizobium	33.30de	23.13e
Mo	24.80f	16.46g
B	31.30e	18.70f
$V.B_{12}$	23.63f	13.33h
Rh+Mo	45.20b	33.80b
Rh+B	45.00b	33.76b
$Rh+V.B_{12}$	52.03a	36.96a
Mo+B	42.53c	33.10b
$Mo+V.B_{12}$	35.13d	24.30ed

B+VB12	34.16d	23.26e
Rh+Mo+B	40.63c	27.20c
Rh+Mo+B+V.B12	35.26c	25.20d
Control	21.33g	11.26 i
LSD(0.05)	2.24	1.46

The importance of Rhizobium bacteria can be explained by increasing the weights in pea plants due to their role on atmospheric nitrogen fixation, protein composition, and the symbiotic relationship between them and pea roots, therefore, it was increasing the total weight of the plant (Clemow, 2010). While, the vitamin B12 important in gaining total plant weight which may be due to its role in the formation of bacterial nodes on the roots of pea plants, and it has a complementary effect to the activity of Rhizobium bacteria (Talukder *et al*., 2008). As well as, Molybdenum has an important role in activating the efficiency of Rhizobium bacteria in the formation of bacterial nodes, and act as an a cofactor in action of different enzymes (Bidwell, 1979). These results obtained with Rhizobium are compatible with (Hristozkova *et al.*, 2005) and (Gad and Abd El-Moez,(2013).

REFERENCES:

1. Ali, M. E., Khanam, D., Bhuiyan, M. A. H., Khatun, M. R., & Talukder, M. R. (2008). Effect of Rhizobium inoculation to different varieties of garden pea (Pisum sativum L.). J. Soil. Nature, 2(1), 30-33.
2. Bidwell, R.G.S. (1979). Plant Physiology.2nded .Mill Publishing Co. New York.
3. Clemow, S. (2010). Wilfridlaurite University; Theses and- 10 Dissertation (Comprehensive)Scholars Commons@ laurie.
4. El-Hamdaoui, A., Redondo-Nieto, M., Rivilla, R., Bonilla, I., & Bolanos, L. (2003). Effects of boron and calcium nutrition on the establishment of the Rhizobium leguminosarum–pea (Pisum sativum) symbiosis and nodule development under salt stress. Plant, Cell & Environment, 26(7), 1003-1011.
5. Gad, N. (2012). Influence of Molybdenum on groundnut production under different nitrogen levels. World Journal of Chemistry, 7(2), 64- 70.
6. Gad, N., & M.R.Abd, El- moez. (2013). Influenced of molybdenum on nodulation ,nitrogen fixation and yield of cow pea. Journal of Applied Sciences Research, 9(3), 1498- 1504.
7. Hristozkova, M., Geneva, M., & Stancher, I. (2006). Response of inoculated pea (Pisum stativumL.) to root and foliar fertilizer application with reduced molybdenum concentration . Institute of Plant Physiology, Bulgarian Academy of Sciences, 73- 79.
8. Hristozkova, M., Stancheve, I., Geneva, M., & Georgiv, G. (2005). Effect of different foliar fertilizer concentrations on pea plants nodulation at reduced MO supply. Bulgarian Academy of Scienes, 365- 372.
9. Hassan, A. A. M. (2001). Fundamentals of Vegetable Crops Production, Arab Publishing House, Cairo, Egypt.
10. Kandela, H., Gad, N., & Abdelhamid, M.T. (2013). Effects of different rates of phosphorus and molybdnum application on two varieties common bean of (Phaseolus vulgaris L.). Journal of Agriculture Food Technology, 3(3), 8- 16.
11. Mehmood, F., Qasim, M., Khan, Z. U. D., & Raza, S. H. (2011). Effect of exogenous supply of boron on nodule development in pea (pisum sativum L.). Pak. J. Bot, 43(3), 2115-2118.
12. Mengel, G., & Kirkby, E.A. (1982). Principals of plant nutrition. Third edition, International Potash Institute Barn, Switzerland, 655pp.
13. Sharma, A. (2016). Effect of bron and lime productivity of garden pea under acidic soils in northwestern Himalayas.Communications in Soil Scienece and Plant Analysis,47(3), 291- 297.
14. Sierra, S., Rdelas, B., Martinez- Tolado, M., & pozoand Gonzalez- Lopez, C. (1999). Production of B- vitamins by two Rhizbioum strains in chemically defined media. Applied Microbiology, 88, 851- 858.
15. Snedecor, G. W., & Cochran, W.G. (1980). Statistical Methods.7 thed. Iowa State University, Press, USA.
16. Subba Rao, N. S. (1984). Soil microorganisms and plant growth. Oxford and IBHP ublishing Co. PVT. Co., New Delhi, Indian pp.84-111.
17. Subba Rao, N. S. (1986). Soil microorganisms and plant growth. Oxford and IBH Publishing Co., New Delhi, pp.123- 183.
18. Talukder, M. S., Solaiman, A. R. M., Khanam, D., & Rabbani, M. G. (2008). Characterization of some Rhizobium isolates and their effectiveness on pea. Bangladesh Journal of Microbiology, 25(1), 45-48.
19. Tubil, K. M. (1989). Fundamentals of soil fertility and fertilization, University Complex, Dinar Printing Press, Tripoli, Libya
20. Broughton, W. J., Zhang, F., Perret, X., & Staehelin, C. (2003). Signals exchanged between legumes and Rhizobium: agricultural uses and perspectives. Plant and Soil, 252(1), 129-137.
21. Zajac, T., Klimek-Kopyra, A., & Oleksy, A. (2013). Effect of Rhizobium inoculation of seeds and foliar fertilization on productivity of Pisum sativum L. Acta Agrobotanica, 66(2).