

## STUDY ON THE SOYBEAN QUALITY AND PRODUCTION INFLUENCED THROUGH NPK FOLIAR APPLICATIONS WITH MICRONUTRIENT AND AMINO ACIDS

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### ABSTRACT

Present study was carried out to observe the influence of NPK foliar applications along with micro nutrient and amino acid on different level through spray. This experiment was performed at Agriculture Research Institute, Tandojam. Present study was performed with three different replications through RCBD Complete Randomized Block Design to assess the growth and yield of crop. Soybean seeds (NARC-II) were sowed in field during the month of June 2022. The foliar applications of NPK with micronutrients include Nitrogen, Phosphorus, and Potassium at a dose of 20-20-20. During the study, micronutrients such as iron, zinc, magnesium, and boron were mixed in the irrigation water for fifteen days at two different levels: 1.8 and 2.0 kg/ha. Following this, amino acids were applied at two levels: 1.0 and 0.5 g/ha. The results of our research showed that foliar application of NPK with amino acids at a rate of 0.5 g/ha along with 2.0 kg/ha of micronutrients improved the vegetative growth of soybean plants compared to the control group. The highest yields and concentrations of nitrogen, phosphorus, and potassium were achieved with foliar applications of NPK combined with increased amino acid content and mixed micronutrients.

**Key-words:** Amino acids, NPK, Foliar, Soybean, Micro nutrient

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### INTRODUCTION

The soybean crop contain the oil food for humans and animals the seed of soybean rich in the protein that's used animals feed as compare to other crops soybean has large quantity of protein such as milk, eggs, fish, and animal meat (Iqbal *et al.*, 2003) soybean enhance the fertility of the soil if the macro and micro nutrients added nitrogen is important element for increasing the growth and production. The yield quality of soybean effected if lower level of nitrogen fertilizer used (Kowalczyk *et al.*, 2008)

The farther study indicate to enhance the production of soybean by adopting of new procedure such as foliar application increases availability of nutrients for plants it is the best procedure to decrease the reduction of various elements including nitrogen reduction by soil gasified and leaching. With the shower of nitrogen foliar fertilizer increase the nitrogen level of plant leaf. The spray method is highly effective as compared with direct use of fertilizer in soil due to hardness of nitrogen and take more time melt on leaves and soil an individual(N, P, Na, Mg, Ca and K) enhance the uptake salinity (Zhao *et al.*, 2011) the plant growth and yield increased by spraying foliar application of macro nutrients by that increase in yield and productivity also support in economic (Deb *et al.*,2006) for the soybean foliar fertilizer is most effective for plant growth and development that also increase the yield. (Kowalczyk *et al.*, 2008)

High levels of nitrogen in soil can be affected by leaching, volatilization, and microbial activity. Plants absorb nitrogen from the soil, and its removal can impact plant growth. Foliar nitrogen application can quickly benefit plants by enhancing enzyme activity. The enzyme system is activated by amino acids, which are important for the process of photosynthesis. When applied as a foliar spray, amino acids improve the quality and physiology of plants, affecting the building blocks of protein synthesis. Amino acids at a level of 0.25 mL/L improve vegetative growth height and dry weight (Khalil *et al.*, 2008). Plants have a requirement for amino acids at critical stages, especially during growth.

### MATERIALS AND METHODS

A field experiment was conducted at Agriculture Research Institution Tandojam (ARI) in Hyderabad, Sindh to study the effects of foliar application of amino acids and NPK with micronutrients (B, Fe, Mn, Zn) on soybean (*Glycine max* L.) variety NARC-II.

The experiment was conducted on June 20, 2022, using commercial fertilizer with an NPK ratio of 20-20-20. Micronutrients were applied as a mix of B, Fe, Mn, and Zn, with B as boric acid, Fe as FeSO<sub>4</sub>, Mn as MnSO<sub>4</sub>, and Zn as ZnSO<sub>4</sub>. Two levels of micronutrients (1.8 and 0.5) and three levels of amino acids (1.0, 0.5, 1.8) were used. Irrigation was done six times during the crop growth period, with the control treatment receiving normal water. Treatments were applied using a hand sprayer. Six treatments were used in total.

- i. Control
- ii. Foliar NPK mixed with micronutrient 1.8 g/L
- iii. NPK mixed with amino acid 1.0 g/L
- iv. NPK mixed with amino acid 0.5 g/L
- v. NPK mixed with micronutrient 0.5 g/L
- vi. NPK mixed with amino acid 1.8 g/L
- vii. NPK mixed with amino acid and micronutrient 2 g/L

Table 1. Physical and chemical analysis of soil under experiment.

Soil characteristics	Soil content
<b>Mechanical analysis:</b>	
Finesand%	23.92
Coarsesand%	8.99
Silt%	11.90
Clay%	51.99
Textural	Clayey
<b>Chemical analysis:</b>	
Organic matter%	1.68
pH*	8.01
EC (dSm-1)**	0.13
CaCO <sub>3</sub> gkg-1	0.19
<b>Solubleions(mmol-1)</b>	
Ca <sup>++</sup>	0.39
Mg <sup>++</sup>	0.24
Na <sup>+</sup>	0.76
K <sup>+</sup>	0.06
CO <sub>3</sub>	-
HCO <sub>3</sub>	0.49
Cl <sup>-</sup>	0.37
SO <sub>4</sub>	0.60
Available-N(gkg-1)	3.11
Available-P(gkg-1)	1.52
Available-K(gkg-1)	0.71

## RESULTS AND DISCUSSION

### Parameters of plant growth:

#### Vegetative Characters:

Our study found that applying NPK fertilizer with a mixture of micronutrients and amino acids at two different levels for Magnesium, Zinc, Ferris, and Boron during the vegetation growth stage (Table 2) had significant effects. The results indicated that NPK with amino acids at concentrations of 1.0 and 0.5 g/l, as well as a control group, were compared. The differences observed in the results may be attributed to the impact of amino acids on photosynthetic rate and plant stomatal conductance, affecting transpiration. Our findings align with previous research (Tantawy *et*

*al.*, 2009) on soybeans, which showed that amino acid fertilizers significantly improved plant height, pod number, dry and fresh plant weight when combined with NPK fertilizer and amino acid at 0.5 g/L. These variations in results could be due to the interactions of proteins and biochemical activities influenced by specific amino acids. At the vegetative stage the maximum values were hold with NPK fertilizer mixed with micro nutrients at 1.80 kgfed<sup>-2</sup> whereas the lower value of these characters contain with foliar fertilizer of NPK with micronutrients Fe plays important role in such as crop physiology and process of photosynthesis (Hu *et al.*, 2008) also Zn enhance the rate of photosynthetic process which give the shows the major changes at vegetative stage of plant zinc is also an element which contain the enzymes that are dehydrate phosphate hydrate Zn reduced the play role in the biosynthesis of IAA hormone that helps in division of cell. The magnesium concerned with the O<sub>2</sub> in photosynthesis which is element of different enzymes systems. That's works in chloroplast which helps to send and remove the electrons in the reaction (Soubeih *et al.*, 2004) and transportation system of electrons shows that the yield of soybean increased after applying Zn at vegetative stage of plant Mn is major element for plant development which incorporate with the reducing NO<sub>3</sub> to NH<sub>4</sub> after taking by plants it also helps in nitrogen fixation N<sub>2</sub> in ammonium form in symbiotic relation leguminous crop (Deb *et al.*, 2006) and (Bhuiyan *et al.*, 2008). Boron (B) it is necessary component for the germination and formation of fruit and transport components of photosynthesis (Malakoti and Keshavarz, 2003). On same table the data shows that the treatment of foliar spray along with micronutrients the intensity significantly dry weight and pure weight can be examine with control. The certain results Mn, Zn, Fe and B play the major role in in the weight increasing dry and fresh weight give top value 2.0 kgf<sup>-1</sup> values confirmed with the result contained by Noor *et al.*, (2004) and Ahmed (2005) the variation in result of plant may be due different function enzyme system physiology and photosynthesis, nitrogen fixation. Carbon fixed portentous enzymes, peptides and phosphor hydrates. The result confirming with obtained by Deb *et al.* (2006), Bhuiyan *et al.* (2008), Hu *et al.* (2008) and Khalil *et al.* (2008). Its showing as the same data on the main vegetative stage of plant enhance by foliar of NPK fertilizers with amino acids 2.0 g/L accompanied with the mixture of micro nutrients as 2.0 kgfed<sup>-1</sup>, result may be effected due to protein synthesis amino acids, biological process formation of photosynthesis, plant physiology and carbohydrates conformation of results are hold by Noor *et al.* (2004).

Table 2. Influence of NPK Foliar application with amino acid and micro nutrient on the vegetative growth of soybean plant.

Fertilizer	Plant	No. of pods	No. of nodes	Fresh	Dry weight g
Control	85.77	40	9	10.96	1.36
FoliarNPK+AS1.4	94.87	43	11	12.87	2..17
FoliarNPK+AS1.8	97.91	44	11	13.91	2..01
FoliarNPK+MM1.6	103.96	51	14	16.89	3.06
FoliarNPK+MM1.8	1112.00	52	12	17.98	3.11
FoliarNPK+AS1.8+	121.01	60	13	18.01	3.19
LSD at 0.05	2.03	1.22	0.20	1.45	0.10

### Production and its components

The results of Table 3 contain production which is affected with micro nutrients, amino acids and foliar of NPK change in chemical composition, yield, growth of economic plant increased after foliar spry of the amino acids. The minimum value assign with control and the maximum value mark with NPK the spraying of amino acids plays major role in protein formation vitamins metabolic and biosynthetic hormones (Berglund, 2002) same result contained by Buchanan *et al.* (2015) who gave the statements that there are many different benefits of applying of nitrogen to cereals NPK fertilizer via as the foliage.

In the same table data shows that spraying of amino acids and NPK effect the yield increased the level at 2.0 g/L compression with 1.5 g/L these results may be affected due to biological process and NPK foliar may be effected .they also effect the rate of transpiration and photosynthesis.

All foliar applications of compound nutrients and NPK results showing high yield against the control 2.0kgfed<sup>-1</sup> micro nutrients were applied significantly improve the yield in same data yield also higher with the 1.5 to 2.0 kgfed<sup>-1</sup> concentration of compound nutrients (B, Zn, Fe and Mn) effects the plant physiology in the process of plant growth

and necessary for carbon fixation in the process of photo synthesis (Hu *et al.*, 2008) there change in the result that higher yield with the foliar of NPK as compare with control.

That is concluded the higher yield were noted with the NPK foliar application and amino acids mixed with the micronutrients when both applied to gather they were absorbed and transport the micronutrients easily inside of plant NPK and amino acids sprayed at particular stage and the requirement of the plant (Berglund, 2002).

Table 3. Influence of NPK foliar with amino acid and micro nutrients on production and its component of soybean plant.

Fertilizer	Seeds per plant	Grains per plant	Grains production per plant	1000 grain weight g	Grain yield (tonfed <sup>-1</sup> )
Control	11	71	16.22	142.45	1.10
FoliarNPK+AS1.4	13	92	18.52	152.00	1.23
FoliarNPK+AS1.8	13	94	19.22	154.91	1.29
FoliarNPK+MM1.6	14	103	19.37	159.03	1.34
FoliarNPK+MM1.8	14	107	20.01	160.89	1.40
FoliarNPK+AS1.8	15	111	20.66	165.00	1.45
LSD at 0.05	0.11	0.52	1.37	1.57	0.10

#### Concentration of Nutrient

The findings of our study revealed that NPK fertilizer mixed with micro nutrient and amino acids on potassium, nitrogen and phosphorus concentration in Table 4 are varied from the control group. Similar results showed by (Sultana *et al.*, 2001), that use of macro nutrient spray with amino acid reduce the nitrification of nitrogen and loss of nitrogen through leaching when nitrogen were utilized in soil. The phosphorus concentration absorbed compared with the fix at plant in the soil. Bhuiyan *et al.* (2008) plant also enhance the up taking of potassium .in the result the higher concentration the leaves were increased rapidly with NPK and amino acids. Plant absorbs the spray the treatment were covered with control result obtained by Ahmed *et al.* (2005).

Table 4. Influence of NPK fertilizer with amino acid and micro nutrient concentration on soybean plant.

Types of fertilization	Nitrogen %	Potassium %	Phosphorus %
Control	1.32	0.12	1.13
NPK Foliar + AS 1.4	2.21	0.17	1.34
NPK Foliar + AS 1.8	2.16	0.22	1.37
NPK Foliar + MM 1.6	2.43	0.24	1.39
NPK Foliar + MM 1.8	2.58	0.18	1.51
NPK Foliar + AS + MM 1.8	2.88	0.26	1.51
LSD at level of 0.05	0.29	0.01	0.11

In the same table data shows that amino acids and NPK at the level 2.0g/L compare at 1.5 g/L increasing in the concentration of nitrogen potassium phosphorus by the spraying of foliar application plant physiological and biological hormones and vitamins with active amino acids Khalil *et al.* (2008), the result may very due NPK Foliar and amino acids on the photosynthesis and transpiration through stomata.

In the same table the result indicates 1.5 kgfed<sup>-1</sup> and 2.0 kgfed<sup>-1</sup> sprayed NPK and micro nutrients (B, Fe, Zn, Mn) with changes in the concentration which was increased N, P and k 1.5 upto 2.0 kgfed<sup>-1</sup> the vegetative growth directly show the effect of increase due to increasing in N, P and Zn, they play vital role in the growth and yield

they are also enzyme activators in the crop photosynthesis (Hu *et al.* (2008). Zn and B also component of enzymes and carbohydrates. Boron is major component of germination. In result shows that high concentration of nitrogen (N) and the lowest is in control. The higher values with the concentration of phosphorus were contain NPK fertilizer and compound nutrients spraying and compared with the control. The result shows that spraying of NPK and micro nutrients absorptions of different elements increased like Ca, Mg, K, and P that may be cause of decrease in the transpiration the maximum value of the phosphorus concentration observed with the foliar application.

### Conclusion

Recent research has shown that amino acids and micronutrients significantly impact the growth and yield of soybeans. Foliar spray applications of micronutrients and NPK have been found to enhance vegetative growth, yield, and quality of soybean plants. The best results were achieved when amino acids were combined with micronutrients, resulting in higher growth and yield characteristics in soybeans.

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