Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6731

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (5):** 766-770 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Foliar Application of Water Soluble Fertilizer on Growth and Yield of Soybean (*Glycine max* L. Merrill)

Sharifi, S. K.[1], Lalitha, B. S.[2*], Qasimullah, R.[3], Prajwal Kumar, G.K.[4] and Manjanagouda S. S.[5]

[1,3]Department of Agronomy, [2]Associate Professor, [4,5]Ph. D. Scholar

Department of Agronomy, College of Agriculture, University of Agricultural Sciences, Bengaluru

*Corresponding Author E-mail: lalithakh@gmail.com

Received: 18.07.2018 | Revised: 29.08.2018 | Accepted: 7.09.2018

ABSTRACT

The field experiment was conducted during 2016-17 at Zonal Agricultural Research Station GKVK, Bengaluru to study the effect of water soluble fertilizer on growth and yield of soybean (Glycine max L. Merrill). The experiment was laid out in randomized complete block design with seven treatments replicated thrice. The recommended dose of fertilizer (RDF) in combination with foliar spray of macro nutrients were taken into study. The results revealed that RDF + foliar application of WSF @ 2 % at flowering and pod filling stage recorded significantly higher growth parameters viz., plant height (46.53 cm), number of branches plant^{-1} (13.87), number of leaves plant^{-1} (70.20), leaf area (1083.62 cm^2), leaf area index (3.95), leaf area duration (96.80 cm^2/day) chlorophyll content (20.02) and total dry weight of soybean (3654.26 kg ha^{-1}) at 60 DAS and yield attributes like days taken for 50 per cent flowering, (40.33), number of pods plant^{-1} (86.18), seed weight plant^{-1} (17.55 g), 100 seeds weight (14.53 g) and seed yield (2283 kg ha^{-1}), recorded with significantly higher values.

Key words: *Foliar application, Water soluble fertilizer, Growth, Yield, Soybean.*

INTRODUCTION

Foliar spray of nutrients is the fastest way to boost up crop growth because, nutrients are available to plants in critical stages and the nutrients will reach the site of food synthesis directly leading to no wastage and quick supply of food, thereby reduce the requirement of fertilizers. Foliar application resulted in efficient absorption and usage which is economical in respect to other methods of fertilization. It is also known that active nodulation of soybean or any pulse crop stops 45-50 days after sowing and at that time for legume plants if supply nutrients through foliar spray found to have beneficial effects on enhancing growth, increasing seed yield and quality parameters. Specific in soybean leaf senescence starts much before completion of pod maturity and which breaks source sink relationship finally lead to unfilled pods and pods with shriveled seeds are major drawbacks in soybean which can be managed through foliar application of nutrients. Nutrient spray at later stages has been found to delay leaf senescence and improved yield.

Cite this article: Sharifi, S.K., Lalitha, B.S., Qasimullah, R., Prajwal Kumar, G.K. and Manjanagouda, S.S., Effect of Foliar Application of Water Soluble Fertilizer on Growth and Yield of Soybean (*Glycine max* L. Merrill), *Int. J. Pure App. Biosci.* **6(5):** 766-770 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6731

Application of inorganic nutrient spray will also enhance the nutrient availability, quick absorption and in turn increases the productivity. According to several studies conducted in different crops by different scientists over the world revealed that retention of flowers are possible through foliar spray of growth regulators and macro nutrients during flower initiation to pod development stages along with soil application. Very little information is available regarding the effect of foliar application of water soluble fertilizer on growth and yield of soybean [*Glycine max* (L.) Merrill]. Therefore the present study is undertaken.

MATERIAL AND METHODS

The present investigation was carried out during 2016-17, in the department of agronomy, College of Agriculture, UAS GKVK, Bengaluru -560065, Karnataka, India. The experiments were laid out in RCBD (Randomized Complete Block Design), Soybean (*Glycine max* L. Merrill), KBS-23 variety were taken into study. The experiment consist of seven treatment which was replicated thrice, recommended dose of fertilizer (RDF) and in combination with foliar spray of macro nutrients were taken into study *viz.*, T_1 - Recommended fertilizer dose, T_2- RDF (50 % N as basal and 50 % N as top dressing), T_3- RDF + foliar application of WSF @ 2 % at 8-12 leaf stage, T_4- RDF + foliar application of WSF @ 2 % at flowering stage, T_5-RDF + foliar application of WSF @ 2 % at pod filling stage, T_6- RDF + foliar application of WSF @ 2 % at flowering and pod filling stage, T_7- Recommended dose of nitrogen through FYM only. Primary tillage was done by disc plough followed by passing cultivator twice, harrowed and leveled to get required seed bed. After the seed bed was prepared, the plots were laid out according to the plan of layout manually.

After bringing the soil to a fine tilth, recommended dose of FYM was applied to each plot and incorporated well in soil one week prior to sowing. Chemical fertilizers were applied as per package of practice. Urea, single super phosphate and muriate of potash to were applied supply nitrogen, phosphorus and potassium, respectively, as per the treatment. The chemical fertilizers were applied in furrows and mixed properly at the time of sowing. The water soluble NPK (19:19:19) was sprayed as per the treatments and the quantity of spray solution used was 500 liters per hectare.

The seeds were dibbled manually in the pre irrigated plots. After sowing of seeds field was given light irrigation immediately and subsequent irrigations were given as per the crop requirement based on the soil moisture content. All plots were kept weed free by pre emergent spray of alachlor at the rate of 1 kg *a.i*. per hectare and hand weeding. Harvesting was done manually from net plot area when the seed became hard and leaves turned yellow in colour and the data were collected regarding growth and yield parameters during the study.

RESULT AND DISCUSSION

The data on growth parameters like plant height, number of branches, number of leaves, leaf area, leaf area index (LAI), leaf area duration (LAD), Chlorophyll content (SPAD meter reading), total dry weight as influenced by foliar application of water soluble fertilizer are presented in Table 1 and 2. The results indicated that significantly higher plant height (46.53 cm), number of branches plant^{-1} (13.87), number of leaves plant^{-1} (70.20), leaf area (1083.62 cm^2), leaf area index (3.95), leaf area duration (96.80 cm^2/day) chlorophyll content (20.02) and total dry weight (3654.26 kg ha^{-1}) at 60 DAS, were recorded with application of RDF + foliar application of WSF @ 2 % at flowering + pod filling stage (T_6) over all other treatments. Followed by application of RDF + foliar application of WSF @ 2 % at pod filling stage (T_5), which was on par with RDF + foliar application of WSF @ 2 % at flowering stage (T_4). Whereas, the recommended dose of nitrogen through FYM only (T_7) had the least effect in all the parameters.

The increase in plant height might be due to application of nutrients at later stages which increased the availability of nutrients for plant growth and development and better utilization of applied major nutrients in addition to biological nitrogen fixation. The results are in agreement with findings of Amany[2] that foliar application of 1 per cent urea on growth of chick pea at pod filling stage resulted in higher plant height. Phosphorus has positive significantly interaction with nitrogen absorption and plant growth[14].

More number of branches was due to improved growth of morphological character like plant height resulted in more number of pods per plant leading to more number of branches. The results are in confirmation with the findings of Amany[2] and[9].

The higher number of leaves might be due to improved growth of morphological characters like plant height and number of branches led to more of leaves additional nitrogen from foliar fertilizer application influenced vegetative growth in plant and reduced fertilizer loss resulted in higher number of leaves per plant. The results are in corroboration with the results of Garud *et al*.[4].

Leaf area index was directly attributed to the higher leaf area. The formation of optimum photosynthetic stage for longer period was essential for increasing yield which was met through the foliar nutrients applied to the soybean crop. On the other side, improved photosynthetic capacity was influenced by the foliar fertilization of major nutrients *viz.,* N, P and K.[17]. The synergistic effect of macro nutrient help in rapid growth and development of plants as they help in photosynthesis and various biochemical processes which responds towards growth Jasim Iqbal *et al.*[6]. Leaf area duration might be due to enhanced nutrient availability made plants to stay green for longer duration when foliar nutrition supplied twice at flowering and pod filling when compared to single application either at flowering or pod filling stage. The higher chlorophyll content (SPAD meter reading) of the leaf is due to steady supply and better utilization of nitrogen applied through soil and foliar. Foliar application nitrogen at flowering and pod filling stage along with RDF resulted in maximum photosynthesis due to more availability of nitrogen in turn enhancing the photosynthetic activity of leaf. The results are in line with work carried out by Senthil Kumar *et al.*[13].

Increased dry matter production is due to balanced proportion of macro nutrients in the foliar fertilization which resulted in better crop growth and photosynthetic activity which has lead to better supply of photosynthates ultimately resulted in higher dry matter production per plant. The results are in confirmation with the findings of Parasuraman *et al.*[10], Thavaprakash *et al.*[16] and Abdou El-Nour[1].

The data on yield parameters like days taken for flowering, number of pods per plant, seed weight per plant, 100 weight, seed yield, as influenced by foliar application of water soluble fertilizer are presented in Table 3. The results indicated that significantly more days taken for 50 per cent flowering, (40.33), higher number of pods plant^{-1} (86.18), seed weight plant^{-1} (17.55 g), 100 seeds weight (14.53 g) and seed yield (2283 kg ha^{-1}), recorded significantly higher values with application of RDF + foliar application of WSF @ 2 % at flowering + pod filling stage (T_6) over all other treatments. Followed by application of RDF + foliar application of WSF @ 2 % at pod filling stage (T_5), which was on par with RDF + foliar application of WSF @ 2 % at flowering stage (T_4). Whereas, the recommended dose of nitrogen through FYM only (T_7) had the least effect in all the parameters.

The improvement in number of pods per plant was due to additive effect of macro nutrients and the results obtained are in confirmative with the findings of Roopashree[12], Thakare *et al.*[15], Ghosh and Joseph[5] and Jyothi *et al.*[7]. he higher growth parameters helped to put forth significantly higher yield attributing characters like number of pods per plant higher seed weight per plant and 100 grain weight were finally led to increased soybean yield. Foliar spray twice during flowering and pod filling stage might

be due to enhanced photosynthetic activity and higher uptake of nutrients and thereby increased plant dry matter production in the pod setting phase which might have improved the pod development and number of pods per plant. Similarly, Kalarani and Moosa Sheriff[8] found increased number of pods with the foliar application of 1.5 % urea and 0.5 % DAP in green gram and Patel and Patel[11] in soybean crop.

Table 1: Plant height, number of branches, number of leaves and chlorophyll content (SPAD meter reading) of soybean as influenced by foliar application of water soluble NPK (19:19:19) fertilizer

Treatments	Plant height (cm)	No. of branches	No. of leaves	Chlorophyll content
T_1	34.13	10.53	61.87	13.58
T_2	34.27	11.53	62.53	14.12
T_3	35.00	11.87	63.33	15.50
T_4	39.87	11.90	64.20	15.29
T_5	42.43	12.73	65.03	18.34
T_6	46.53	13.87	70.20	20.02
T_7	33.23	10.07	61.40	13.22
S.Em±	1.24	0.22	1.52	0.48
CD. (p=0.05)	3.82	0.68	4.68	1.47

Table 2: Leaf area, Leaf area index, Leaf area duration and Total dry weight of soybean as influenced by foliar application of water soluble NPK (19:19:19) fertilizer

Treatments	Leaf area (cm^2)	Leaf area index	Leaf area duration	Total dry weight of plant (kg ha^{-1})
T_1	879.22	3.26	59.90	2718.33
T_2	897.20	3.32	60.12	2611.11
T_3	914.60	3.38	65.24	2914.81
T_4	920.90	3.40	64.41	3042.25
T_5	947.68	3.49	70.45	3358.42
T_6	1083.62	3.95	96.80	3654.26
T_7	806.03	3.02	46.95	2333.33
S.Em±	39.74	0.13	6.72	90.90
CD. (p=0.05)	122.45	0.41	20.69	280.10

Table 3: Days taken for 50% flowering, number of pods $plant^{-1}$, seed weight (g) $plant^{-1}$, 100 seed weight (g) and Seed yield kg ha^{-1} of soybean as influenced by foliar application of water soluble NPK (19:19:19) fertilizer

Treatments	Days taken for 50% flowering	Pods $plant^{-1}$	Seed weight (g) $plant^{-1}$	100 seed weight (g)	Seed yield (kg ha^{-1})
T_1	37.33	63.93	14.80	13.03	1533
T_2	36.33	64.27	13.03	13.37	1518
T_3	36.67	64.67	14.63	13.60	1637
T_4	38.78	69.13	13.33	13.53	1782
T_5	38.98	71.31	15.03	13.63	2006
T_6	40.33	86.18	17.55	14.53	2283
T_7	35.67	57.87	12.42	12.63	1296
S.Em±	0.33	3.87	0.92	0.29	44.74
CD. (p=0.05)	1.00	11.92	2.84	0.88	137.87

REFERENCES

1. Abdou El-Nour, E. A. A., can supplemented potassium foliar feeding reduce the recommended soil potassium? *Pakistan J. Biol. Sci*., **5(3):** 259-262 (2002).
2. Amany, A. B., Effect of plant density and urea foliar application on yield and yield components of chickpea (*Cicera rietinum* L.). *Res. J. Agric. & Biol. Sci.,* **3(4):** 220-223 (2007).
3. Chandrasekhar, C. N. and Bangarusamy, U., Maximizing the yield of mung bean by foliar application of growth regulating chemicals and nutrients. *Madras Agric. J*., **90(1-3):** 142-145 (2003).
4. Garud, H. S., Awasarmal, V. B., Pawar, S. U. and Bhusawar, P. V., Yield economics and quality of soybean as influenced by foliar and soil application of phosphatic fertilizer. *Intl. J. Trop. Agric*., **33(2):** 709-712 (2015).
5. Ghosh, M. K. and Joseph, S. A., Influence of Bio fertilizers, foliar application of DAP and sulphur sources on yield and yield attributes of summer green gram (*Vigna radiata* L. Wilczek) *Legume Res*., **31(3):** 232 – 233 (2008).
6. Iqbal, J., Khan, R., Wahid, A., Sardar, K., Khan, N., Ali, M., Hussain, M., Ali, W., Ali, M. And Ahmad, R., Effect of nitrogen and zinc on maize (*Zea mays* L.) Yield components and plant concentration. *Adv. in Envi. Biology*, **10(10):** 203-208 (2016).
7. Jyothi, C. N., Ravichandra, K. and Babu, S. K., Effect of Foliar Supplementation of Nitrogen and Zinc on Soybean (*Glycine max*. L.) Yield, Quality and Nutrient Uptake. *Indian J. Dryland Agric. Res. & Dev*. **28(2):** 46-48 (2013).
8. Kalarani, M. K. and Moosa Shariff, M., Increasing yield due to delaying leaf senescence by the foliar fertilization of NPK & b. *Madras Agric. J*., **81(3):** 171-172 (1994).
9. Krishnaveni, S., Anandha, P. A. and Mahendran, S., Effect of foliar spray of nutrients on growth and yield of green gram (*Phaseolus radiatus). Legume Res*., **27(2):** 150 (2004).
10. Parasuraman, P., Studies on integrated nutrient requirement of hybrid maize (*Zea mays* L.) under irrigated conditions. *Madras Agric. J.*, **92(1&3):** 89-94 (2008).
11. Patel, T. R. and Patel, Z. G., Effect of foliar fertilization of nitrogen and phosphrous on growth and yield of summer green gram. *Indian J. Agron*., **39(4):** 578-580 (1994).
12. Roopashree, D. H., Effect of organic manures, mulching and potassium levels on growth, yield and quality of baby corn (*Zea mays* L.). *Ph. D. Thesis*, UAS, Bengaluru (2013).
13. Senthil Kumar, G., Muthukrishnan, P., Ramasamy, S. and Chandaragiri, K. K., Effect of organic and inorganic foliar spray on growth and yield of blackgram (*Vigna mungo* L.*). Madras Agric. J.*, **95(1-6):** 57-60 (2008).
14. Sumner, M. E. and Farina, M. P. W., Phosphorus interactions with other nutrients and lime in field cropping systems. *Adv. Soil Sci.*, **5:** 201-236 (1986).
15. Thakare, K. G., Chore, C. N., Deotale, R. D., Kamble, P. S., Pawar, S. B. and Lende, S. R., Influence of nutrients and hormones on biochemical and yield and yield contributing parameters of soybean. *J. Soils and Crops*, **16(1):** 210-216 (2006).
16. Thavaprakaash, N., Velayudham, K. and Panneerselvam, S., Foliar nutrition of baby corn. *Archives Agron. Soil Sci*., **52(4):** 419 – 425 (2006).
17. Watson, D. J., The physiological basis for variation in yield. *Adv. Agron*., **4:** 101-145 (1952).