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Influence of different levels of phosphorous and pulse magic on growth and yield of soybean

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Abstract
A field experiment was carried out during late *Kharif*-2019 at Zonal Agricultural and Horticultural Research Station (ZAHRS), Babbur farm, Hiriyur, to study the effect of different levels of phosphorous and foliar spray of pulse magic on soybean under Central Dry Zone of Karnataka. Experimental design adopted was RCBD with three replications and nine treatments consisting of different levels of phosphorous *viz.*, 75 % and 100 % RDP and foliar application of pulse magic (0.5 %, 1 % and 1.5 %) with first spray during 50 per cent flowering stage and second spray during 15 days after the first spray along with recommended dose of fertilizers. Pulse magic contained nitrogen 10 per cent, phosphorus 40 per cent, micronutrients 03 per cent and PGR 20 ppm. The results revealed that, basal dose of 100 % RDF along with foliar spray of pulse magic at 1.5 % recorded significantly higher plant height (52.56 cm), number of branches plant^{-1} (10.97), number of leaves plant^{-1} (7.40), total dry matter production (50.47 g plant^{-1}), number of pods plant^{-1} (51.34), test weight (13.88 g), seed yield (2476.34 kg ha^{-1}) and haulm yield (3986.37 kg ha^{-1}) over control.

Keywords: pulse magic, soybean, micronutrients, PGR, growth and yield

Introduction
Soybean (*Glycine max* L.) popularly known as 21st century golden bean or miracle crop due to its versatile nutritional qualities having 20 per cent oil and 40 per cent high-quality protein with high levels of essential amino acids such as lysine (5 %), minerals (4 %), phospholipids (2 %) and vitamins *viz.*, Riboflavin and thiamine (Dash *et al.*, 2005) [6]. Its edible oil contains around 1.6 to 3.1 per cent lecithin, which is essential for the development of nerve tissue and its oil is used as a raw material in the manufacture of antibiotics, paints, varnishes, adhesives, lubricants, *etc.* Being a leathery crop, by rhizobial symbiosis (Srivastava *et al.*, 1984) [9], atmospheric nitrogen can be fixed in the soil to the extent of 65 to 100 kg per hectare depending on the soil type, organic matter and climate condition. Soybean is a Chinese native, now relatively well known to the world. Next to wheat, rice and maize, it has been recognized as one of the most important food crops in the world. Soybean is a major oilseed crop of the world grown over an area of 118.01 million hectares with a production of 315.06 million tons and a productivity of 2.67 t per hectare (Anon., 2018). It is grown primarily in the United States, Brazil, China, Argentina and India throughout the world. India has ranked fifth on the soybean world map. As an oilseed crop to overcome the shortage of edible vegetable oil, soybean cultivation in India is increasing rapidly after oil extraction meal has an equally important use for export and domestic food industry. It has revolutionized the rural economy and significantly improved Indian farmer's socioeconomic status. Soybean is cultivated worldwide on 7.5 crores ha. After the USA, Brazil, China and Argentina, India is ranked 5th in area and production. In *Kharif*-2018, all India's estimated soybean area and production was 10.76 million ha and 93.50 million MT, respectively. Estimated area and production was 3.7 lakh ha and 39.41 million MT respectively in Maharashtra during *Kharif*-2018. Madhya Pradesh has a substantial contribution, about 60 per cent of India's total area and production, and ranks first both in the area and in production. The estimated area and production in Madhya Pradesh during *Kharif*-2018 was 5.10 lakh ha and 40.10 million MT respectively. Thus it is well known as the "Soya State" (SOPA *Kharif*-2018) [8].

Foliar application of nutrients is one of the significant milestones in the progress of agricultural production. Due to the availability of soluble fertilizers, it has become more important in recent years and is of great importance in rainfed areas and under changing climatic conditions. Recent studies have shown that foliar feeding has a positive impact on improving crop yield and quality. During the time of sowing, the nutrients applied through the fertilizers are not completely utilized by the crop and most are lost at the later stage, the crop can suffer from a lack of nutrients. Accordingly, additional foliar fertilization is one of the strategies used to improve nutrient use efficiency and quality of crops.

The foliar application of nutrients to increase and maximize the crop's genetic potential is considered an effective and economical method of supplementing the requirement for nutrients. The use of inorganic nutrients alone or in combination with plant growth regulators will also improve the availability of nutrients and in turn, increase productivity. Nutrients play a vital role in boosting pulses seed yield (Chandrasekhar and Bangarusamy, 2003) [3].

Foliar application of nutrients is more advantageous than soil application, as well as avoiding the depletion of these nutrients in leaves, resulting in a higher photosynthetic rate, better nutrient translocation from the leaves to the developing seeds. Foliar application is credited with the benefit of rapid and efficient nutrient utilization, loss elimination through leaching and fixation, and helps regulate plant nutrient uptake (Manonmani and Srimathi, 2009) [7]. The pulse magic contains 10 per cent nitrogen, 40 per cent phosphorus, 3 per cent micronutrients and 20 ppm PGR. It was developed in 2014 by the University of Agricultural Sciences, Raichur, Karnataka. Foliar spray of pulse magic will improve both growth parameters and yield attributes. (Thakur *et al*., 2017 [11] and Teggelli *et al.*, 2016) [10].

Material and Methods

The experiment was conducted during late *Kharif* of 2019 at Zonal Agricultural and Horticultural Research Station (ZAHRS), Babbur farm, Hiriyur. It falls under the region X and agro-climatic zone IV (Central dry zone) of Karnataka. Geographically an experimental site was located at 13º 94' 38" North latitude and 76º 61'61" East longitude, with an altitude of the 630 meters above mean sea level. The soil of the experimental site was sandy clay loam in texture with pH 8.13, Electrical conductivity (EC) of 1.12 dS m^{-1} and organic carbon (OC) containing (3.70 g kg^{-1}). The low in available nitrogen (276 kg ha^{-1}), medium in phosphorus (41 kg P_2O_5 ha^{-1}) and high potassium (350 kg K_2O ha^{-1}). The exchangeable Ca and Mg (5.50 and 2.43 cmol (p^+) kg^{-1}) were adequate, respectively, and the available sulphur was high (14.05 mg kg^{-1}). Among the micro-nutrients, only Fe (4.32, mg kg^{-1}) was sufficient while Mn, Zn and Cu were deficient (1.78, 0.51 and 0.18 mg kg^{-1}) respectively. During the cropping period, the total actual rainfall received was 788.4 mm.

Field experiment was laid out in Randomized Complete Block Design with nine treatments and three replications. Treatments consisting of different combinations of phosphorous levels and foliar application of pulse magic with first spray during 50 per cent flowering stage and second spray during 15 days after the first spray along with the package of practice and recommended dose of fertilizers *viz.*, T_1: RDF (30:80:37.5 kg ha^{-1} NPK) 100 per cent NPK, T_2: RDP 100 per cent, T_3: RDP 75 per cent, T_4: RDP 100 per cent + 0.5 per cent pulse magic foliar spray, T_5: RDP 100 per cent + 1 per cent pulse magic foliar spray, T_6: RDP 100 per cent +1.5 per cent pulse magic foliar spray, T_7: RDP 75 per cent + 0.5 per cent pulse magic foliar spray, T_8: RDP 75 per cent + 1 per cent pulse magic foliar spray, T_9: RDP 75 per cent + 1.5 per cent pulse magic foliar spray. The recommended dose of N and K is common for all treatments except treatment 2 and 3. The recommended dose of FYM is common for all treatments. Variety used is MAUS-2 it matures in 100 to 110 days with average yield ranging from 15 to 25 q ha^{-1}. All the biometric observations are recorded were subjected to analysis.

Results and Discussion

The influence of different levels of phosphorous and pulse magic on growth parameters of soybean

Significantly higher growth parameters were recorded in the treatment received: RDP 100 per cent +1.5 per cent pulse magic foliar spray (T_6) at 60, 90 DAS and at harvest except at 30 DAS. Plant height is an important growth parameter that reflects the vegetative growth behaviour of the crop to the applied nutrients. The plant height was progressively increased as the age of crop advanced up to harvest, significantly higher plant height (39.00, 44.86 and 52.56 cm was recorded at 60, 90 DAS and at harvest, respectively). The increased plant height may be due to foliar spray of pulse magic contained nitrogen 10 per cent, phosphorus 40 per cent, micronutrients 03 per cent and PGR 20 ppm which resulted in the rapid cell division and cell enlargement in the meristematic region and other cytological changes such as an increase in cell wall plasticity and permeability of cell membrane. The findings are in line with the Aktar *et al.* (2007) [1].

Branching is the important growth parameter in pulse crops like soybean, as tillering in cereals, number of branches per plant decides the number flowers and pods in the soybean. Significantly maximum number of branches (9.17, 10.30 and 10.97 branches of soybean $plant^{-1}$ at 60, 90 DAS and at harvest, respectively) and maximum number of leaves $plant^{-1}$ (55.66, 15.52 and 7.40 $plant^{-1}$ at 60, 90 DAS and at harvest, respectively) was noticed in the treatment T_6. The higher number of branches and leaves might be due to hastening various metabolic process *viz.*, photosynthesis, symbiotic biological N_2 fixation process and higher nutrient availability at the initial stage of the crop because of combined application of organic manures with inorganic fertilizers to the soil and foliar spray of pulse magic contained nitrogen 10 per cent, phosphorus 40 per cent, micronutrients 03 per cent and PGR 20 ppm, increases the sprouting of auxiliary buds. Increasing the total dry matter output (TDM) per plant is the first prerequisite for higher yields. Accumulation of dry matter is a significant index representing the plant's growth and metabolic efficiency which ultimately influences crop yield. The amount of TDM produced is an indication of the overall efficiency of resource utilisation and better interception of light. Significantly higher total dry matter production (18.77 and 50.47 g $plant^{-1}$ at before pod formation and at harvest, respectively) were produced in the treatment T_6. Greater total dry matter accumulation was associated with the higher plant height, the number of branches and number of leaves which led to higher accumulation photosynthates. Chavan *et al.* (2014) [4] reported that combined application of organic and inorganic fertilizers along with a foliar spray of micronutrients was reduced chlorophyll degradation and protease activity, which in turn facilitated soluble protein and photosynthetic enzyme synthesis resulting in a longer period of more assimilatory surface area and extended photosynthesis supply to the growing sinks in soybean.

The influence of different levels of phosphorous and pulse magic on yield and yield parameters of soybean

Seed yield governed by number of factors which have direct or indirect impacts. The improvement in seed yield is achieved through improvement in yield attributing characters *viz.*, number of pods per plant, test weight, seed yield and haulm yield.

In the present investigation, application of foliar spray of pulse magic with first spray during 50 per cent flowering stage and second spray during 15 days after the first spray along with the package of practice and recommended dose of fertilizers was increased the yield attributing characters and it may be due to the greater assimilatory leaf area as it is a major source for supplying assimilates to developing organs and seeds in crops. Significantly higher number of pods $plant^{-1}$ (51.34) and test weight (13.88 g) was observed in treatment T_6. The higher yield parameters in this treatment might be due to more productive branches per plant,

number pods per plant and test weight. Better plant performance in these treatments due to the balanced application of phosphorus and pulse magic. Due to increase in yield attributing characters, which finally increased the seed yield (2476 kg ha^{-1}) and haulm yield (3986 kg ha^{-1}).

Foliar application of micronutrients at flowering and 20 days after the first spray would have helped for reducing flower drop and contributed more for reproductive parts resulting in an increased number of pods plant^{-1}. The results are in agreement with those of Chittapur *et al*. (1994) [5].

Table 1: The influence of different levels of phosphorous and pulse magic on growth parameters of soybean

Treatments	Plant height			No. of branches plant^{-1}			No. of leaves plant^{-1}			Total dry matter (g plant^{-1})		
	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	At harvest
T_1	33.80	37.48	44.43	5.96	6.46	7.10	46.15	8.22	3.96	5.38	13.83	42.10
T_2	31.50	36.86	43.38	5.82	5.96	6.93	45.89	7.98	3.50	5.21	12.91	41.20
T_3	30.24	35.61	41.73	5.71	5.92	6.27	43.66	7.55	3.28	5.13	12.07	39.30
T_4	34.33	39.24	46.19	6.75	7.63	8.35	49.33	9.52	4.80	5.57	15.29	43.10
T_5	36.00	40.96	48.59	7.83	8.70	9.15	52.22	10.85	5.87	5.73	16.96	44.90
T_6	39.00	44.86	52.56	9.17	10.30	10.97	55.66	12.52	7.40	5.95	18.77	50.47
T_7	34.00	38.52	45.73	6.33	6.78	7.85	48.29	8.90	4.26	5.49	14.67	42.80
T_8	35.25	40.16	47.28	7.67	8.37	8.91	51.17	9.91	5.14	5.65	16.11	43.90
T_9	37.00	41.29	50.39	8.47	9.52	10.11	53.20	12.15	6.80	5.87	17.15	47.93
S. Em.±	1.14	1.39	1.65	0.26	0.28	0.29	1.72	0.41	0.21	0.26	0.64	1.46
CD @ 5%	3.43	4.18	4.95	0.78	0.83	0.88	5.16	1.24	0.64	NS	1.92	4.38

Table 2: The influence of different levels of phosphorous and pulse magic on yield and yield parameters of soybean

Treatments	No. of pods plant^{-1}	Test weight (g)	Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
T_1	40.67	11.92	17.35	33.00
T_2	39.00	11.75	15.66	30.85
T_3	37.67	11.52	14.32	30.33
T_4	45.00	12.25	21.02	34.82
T_5	47.33	12.98	22.13	36.15
T_6	51.34	13.88	24.76	39.86
T_7	42.67	12.10	19.59	33.67
T_8	46.33	12.26	22.11	35.75
T_9	47.67	13.10	23.04	38.08
S.Em.±	1.60	0.40	0.79	1.12
CD @ 5%	4.81	NS	2.36	3.34

Conclusion

The application recommended dose of N, P_2O_5, K_2O + pulse magic @ 1.5 per cent + FYM @ 6.25 t ha^{-1} is more beneficial and economically advantageous to improve grain yield and haulm yield (2476 kg ha^{-1} and 3986 kg ha^{-1}, respectively) of the soybean under rainfed condition in Central Dry Zone of Karnataka.

References

1. Aktar A, Ali E, Islam MMZ, Karim R, Razzaque Ahm. Effect of GA_3 on growth and yield of Mustard. Int. J. Sust. Crop Prod. 2007; 2:16-20.
2. Anonymous. 3rd Annual report, Ministry of agriculture and farmers welfare, Govt. of India, 2018.
3. Chandrasekhar CN, Bangarusamy U. Maximizing the yield of mungbean by foliar application of growth-regulating chemicals and nutrients. Madras Agric. J. 2003; 90(1-3):142-145.
4. Chavan NG, Bhujbal GB, Manjare MR. Effect of seed priming on-field performance and seed yield of soybean [Glycine max (L.) Merill] varieties. The Bioscan. 2014; 9(1):111-114.
5. Chittapur BM, Hiremath SM, Meli SS. Performance of maize and green forage yield of legumes in maize + forage legume intercropping system in Northern transitional tract of Karnataka. Farming systems. 1994; 10:11-15.
6. Dash AC, Tomar GS, Katkar PH. Effect of integrated nutrient management on growth and dry matter accumulation of soybean [Glycine max (L.)]. J. Soils Crops. 2005; 15(1):39-45.
7. Manonmani V, Srimathi P. Influence of mother crop nutrition on seed and quality of blackgram. Madras Agric. J. 2009; 96(16):125-128.
8. SOPA, Kharif, 2018. The Soybean Processors Association of India. http://www.sopa.org/
9. Srivastava Hv, Bhaskaran S, Bhartendu Vastya, Menon KKG. Oilseed production constraints and opportunities. In soybean miracle oilseed crop its prospectus and constraints in Bihar plateau. Oxford and IBH pub co. New Delhi, 1984, 219-232.
10. Teggelli Rg, Salagunda S, Ahamed Bz. Influence of pulse magic application on yield and economics of transplanted pigeon pea. Int. J. Sci. Nat. 2016; 7(3):598-600.
11. Thakur V, Patil RP, Patil JR, Suma TC, Umesh MR. Influence of foliar nutrition on growth and yield of soybean (Glycine max L.). Under rainfed condition. Journal of Pharmacognosy and Phytochemistry. 2017; 6(6):33-37.