



Effect of Potassium Salt of Active Phosphorous on Growth, Yield and Quality Contributing Attributes of Soybean

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ABSTRACT

An experiment was conducted to examine the effect of potassium salt and active phosphorus on growth, yield and quality contributing parameters in soybean crop during two consecutive years *kharif* 2018-19 and 2019-20. The experiment comprises of 9 treatments *i.e.*, RDF+plant protection measure (T1) ; T1+ PSAP @ 4g/l (T2) ; RDF+50 % PPM (T3) ; T3 + PSAP @ 4g/l (T4) ; RDN+50 % P & K + PPM (T5) ; T5 + PSAP @ 4g/l (T6) ; RDN +50 % P, K + 50 % PPM (T7) ; T7 + PASP @ 4 g/l (T8) and RDN+PASP @ 4g/l (T9) . The experiment was carried out in alkaline nature of vertisols with soybean variety JS-2034 in randomized block design and replicated thrice. The plant protection measures includes quinalphos 25 EC @ 1L/h , Trizophos @ 0.8 L/h and propenophos @ 1.25 L/h during the crop period. The RDF of N: P: K: S @ 25: 60: 40: 40 kg/ha were applied as basal dose at the time of sowing through straight fertilizers like urea, SSP, and MOP .The product potassium salt and active phosphorous (PSAP) was applied as a 1st spray of PSAP @ 4g/l, 40 DAS at Pre-flowering stage, 2nd spray at 55 DAS and 3rd spray 70 DAS, simultaneously. The recorded data showed the maximum plant height (70.3cm) was observed in T2 (RDF+PPM+PSAP) while minimum (66.9 cm) in T9 (RDN and PSAP). The similar trends were also observed for number of pods per plant, number of grain per plant, weight of grain per plant, yield per plot, respectively. The maximum yield 11.44 q/ha was recorded with application of PSAP along with RDF and plant protection measures while the minimum yield was noticed in case of PSAP application with RDN only. Data of experiment revealed that application of potassium salt of active phosphorus on trypsin inhibitor activity was higher (8.34 mg/g) in T 2, the minimum White flies (2.97 leaf /plant) was recorded in T1(RDF+PPM) while maximum (4.63 leaf / plant) in T9. The lower infestation of Girdle beetle (0.92 mrl) and semilooper (0.69 mrl) were found in T2 while higher in T9, may be due to vegetative foliage. It was observed that the RDF +PPM and PSAP have slight significant impact on insect pest control in soybean crop.

Key Words: Growth, Oilseed, Soybean, Vertisols, Yield.

INTRODUCTION

Soybean (*Glycine max* L) is an important major oilseed crop of Madhya Pradesh during *kharif* season. Among the macro nutrients phosphorus is very important for translocation in plant body and potash plays very vital role, but if applied through chemical fertilizers get fixed in the soil and hardly 10-13% is available to crop plants. In current scenario, soybean production and productivity are facing huge problems of imbalanced nutrition, scarcity of moisture as well as insect pest diseases infestation

in the state. Generally, the farmers are not given the emphasis of potassium nutrition in soybean crop. Potash salt of active phosphorus (PSAP) is an important invention as through its foliar applications both these nutrients get absorbed quickly in the plants and performs their vital role of regulating the different activities, reducing the insect pest diseases incidence hence enhancing overall growth, yield and quality attributes of soybean. In PSAP, phosphorus is activated by a catalytic process, and by using the split technique, potash is attached to

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Table 1. The details of treatments included in the experiment

Treatment	Details
T1	RDF+plant protection measure
T2	RDF+plant protection measure+PSAP @ 4g/l
T3	RDF+50 %plant protection measure
T4	RDF+50 %plant protection measure + PSAP @ 4g/l
T5	Recommended dose N+50 % P, K & plant protection measure
T6	Recommended dose N+50 % P, K & plant protection measure+ PSAP @ 4g/l
T7	Recommended dose N+50 % P, K & 50 %plant protection measure
T8	Recommended dose N+50 % P, K & 50 %plant protection measure +PASP @ 4g/l
T9	Recommended dose N+PASP @ 4g/l

this activated phosphorus, which is extremely water soluble 180 per cent and gets absorbed 100per cent in plants leaves and does not fixed in soil it confirmed by Verma and Billlore (2020). Signifying the importance of balanced nutrition, an experiment was carried out to assess the effect of potassium salt of active phosphorus on growth, yield and quality contributing parameters in soybean crop during two consecutive years *kharif* 2018-19 and 2019-20.

MATERIALS AND METHODS

A field experiment was organized to find out the effect of PSAP on soybean crop, during two consecutive years in *kharif* 2018-19 and 2019-20 on instructional farm, of Krishi Vigyan Kendra Dewas. The experiment was carried out in randomized block design which comprises of 9 treatments and replicated thrice (Table 1). The experimental plot size was 2.5m X 4m and maintained isolation distance 0.5m between PXP. The soils of experimental plots were analyzed pre and post conduction of the experiment by adopting standard analytical procedure (Black, 1965). Soil was alkaline in nature and available Nitrogen and Phosphorus ranges between low to medium and potassium at higher side while micronutrients were generally below critical level.

The soybean crop early maturing variety JS-2034 was selected for the experimental trial and sown at 30 cm row to row distance, on 28th June, 2018 and 10th July, 2019, simultaneously by adopting all technological packages and practices *i.e.*, seed treatment, weeding etc. The seeds were treated by the fungicide carboxin 37.5% + thiram 37.5% @ 2.5g/kg, insecticides thiamethoxazole 30FS @ 10 ml/kg, and rhizobium and phosphate solubilizing bacteria @ of 5ml each/kg of seed, respectively. Recommended doses of fertilizer of N: P: K: S @ of 25: 60: 40: 40 kg/ha were applied as basal dose at the time of sowing through straight fertilizers like urea, SSP, and MOP. The standard integrated plant protection measure was followed like that 1st spray of trizophos 40 EC and 2nd spray of profenophos 50 EC, respectively. The product potassium salt and active phosphorous (PSAP) was sprayed as per given protocol under the experiment which was offered by Isha Agro Science Pvt. Ltd. Pune India. The 1st spray of PSAP @ 4g/l was applied on 40 DAS at Pre-flowering stage, 2nd spray on 55 DAS and 3rd spray at 70 DAS, simultaneously. The observations of various yield attributes (plant height, number of pods per plant, number of grains per pod, weight of grain per plant, 100 seed weight etc.) and quality contributing parameters (trypsin inhibitor,

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Table 2. Effects of PSAP on growth and yield attributes of soybean

Treatment	Treatment detail	Plant height (cm)	No. of pods/ plant	No. of grain/ plant	Weight of grain/ plant (g)	Yield/ plot (kg)	Yield (q/ha)
T ₁	RDF+ plant protection	70.15	18.13	36.27	2.18	1.09	10.88
T ₂	RDF+plant protection+PSAP	70.33	19.07	38.13	2.29	1.14	11.44
T ₃	RDF+50 %plant protection	67.92	14.87	29.73	1.78	0.89	8.92
T ₄	RDF+50 % plant protection +PSAP	68.70	15.13	30.27	1.82	0.91	9.08
T ₅	Recommended dose N+50 % P, K & plant protection	69.30	16.60	33.20	1.99	1.00	9.96
T ₆	Recommended dose N+50 % P, K & plant protection+ PSAP	69.92	17.13	34.27	2.06	1.03	10.28
T ₇	Recommended dose N+50 % P, K & 50 % plant protection	68.94	15.40	30.80	1.85	0.92	9.24
T ₈	Recommended dose N+50 % P, K & 50 % plant protection +PASP	69.42	15.60	31.20	1.87	0.94	9.36
T ₉	Recommended dose N+PASP	66.54	14.20	28.39	1.70	0.85	8.52
S.Em (±)		1.14	0.45	0.9040	0.05	0.03	0.27
CD at 5%		3.43	1.35	2.71	0.16	0.08	0.81
CV		5.22	8.75	8.75	8.75	8.75	8.75

protein% and fat %,) insect pest and disease incident and effect on soil parameters were recorded time to time during the both year of experiment. The data for insect and pest infestations were taken pre and post spray of insecticide. The pooled data were analyzed by adopting simple RBD design by using standard procedure (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

Effect on Growth, yield and quality attributes

The results showed that the application of

PSAP increased; yield contributing parameters and yield of soybean. The maximum plant height (70.3cm) was observed in T₂ (RDF+PPM+PSAP) while minimum (66.9 cm) in T₉ (RDN and PSAP). The similar trends were also observed for number of pods per plant (19.07), number of grain per plant (38.13), weight of grain per plant (2.29g), yield per plot (1.14kg), respectively (Table 1). The maximum yield 11.44 q/ha were recorded with application of PSAP along with RDF and plant protection measures (T₂) while the minimum yield was noticed in case of PSAP application with RDN

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Table 3. Effect of PSAP on incidents of insect, pest, disease and natural fauna.

Treatment	Details	Whitefly (3leaf/plant)		Green semilooper (mrl)		Tobacco Caterpillar (mrl)		Girdle beetle (mrl)		Pod damage (%)	Yellow vein mosaic (PDI)	Coccinella (mrl)	chrysoperla	Predatory spider
		BF	AF	BF	AF	BF	AF	BF	AF					
T ₁	RDF+plant protection	4.80	2.97	2.70	0.81	2.53	1.22	1.30	0.97	4.77	1.36	0.31	0.36	0.66
T ₂	RDF+ plant protection+PSAP	5.00	3.00	2.73	0.69	2.63	1.25	1.53	0.92	4.15	1.55	0.29	0.34	0.63
T ₃	RDF+50 %plant protection	4.17	3.97	2.80	1.40	2.57	2.20	1.67	1.40	7.23	2.58	0.56	0.58	0.98
T ₄	RDF+50 % plant protection +PSAP	4.75	3.80	2.57	1.42	2.40	2.18	1.70	1.38	7.11	2.60	0.60	0.54	0.84
T ₅	Recommended dose N+50 % P, K & plant protection	4.15	3.27	2.30	1.03	3.00	1.37	1.50	0.87	5.33	1.91	0.35	0.46	0.60
T ₆	Recommended dose N+50 % P, K & plant protection+ PSAP	4.08	3.18	2.63	1.00	2.43	1.45	1.60	0.86	4.68	1.88	0.34	0.48	0.74
T ₇	Recommended dose N+50 % P, K & 50 %plant protection	4.65	3.38	2.27	1.53	2.53	2.18	1.83	1.58	6.71	2.59	0.49	0.49	0.77
T ₈	Recommended dose N+50 % P, K & 50 %plant protection +PASP	3.90	3.77	2.10	1.52	2.97	2.22	1.53	1.43	6.98	2.67	0.53	0.56	0.84
T ₉	Recommended dose N+PASP	4.25	4.63	2.40	2.90	2.70	3.02	1.50	2.40	8.83	3.55	1.86	1.61	2.24
SEm (±)		0.19	0.22	0.14	0.10	0.12	0.11	0.10	0.11	0.48	0.05	0.03	0.05	0.04
CD at 5%		0.56	0.67	0.43	0.31	0.36	0.33	0.30	0.34	1.45	0.14	0.10	0.15	0.11
CV		13.36	19.66	18.20	23.99	14.14	18.47	19.92	27.17	24.47	6.59	17.37	26.42	12.84

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Table 4. Effect of PSAP on benefit cost ratio.

Treatment	Treatment Details	Yield (q/ha)	Cost of cultivation (Rs)	Gross return (Rs)	Net Return (Rs)	B:C
T ₁	RDF+ plant protection	10.9	32350	43218.5	10868.5	1.34
T ₂	RDF+plant protection +PSAP	11.4	34950	45201	10251	1.29
T ₃	RDF+50 % plant protection	8.9	30350	35288.5	4938.5	1.16
T ₄	RDF+50 %plant protection +PSAP	9.1	33950	36081.5	2131.5	1.06
T ₅	Recommended dose N+50 % P, K & plant protection	10.0	30950	39650	8700	1.28
T ₆	Recommended dose N+50 % P, K & plant protection+ PSAP	10.3	32950	40839.5	7889.5	1.24
T ₇	Recommended dose N+50 % P, K & 50 %plant protection	9.2	28350	36478	8128	1.29
T ₈	Recommended dose N+50 % P, K & 50 % plant protection +PASP	9.4	31950	37271	5321	1.17
T ₉	Recommended dose N+PASP	8.5	29950	33702.5	3752.5	1.13

only (T₉) which was significantly higher in treated plot as compare to absolute control. The results were in conformity by the study of Agrios (2005) and Verma and Billlore (2020).

Effect on insect -pests and disease incidence

The pooled data of two year experiments revealed that the minimum white flies (2.97 leaf / plant) were recorded in T₁while maximum (4.63 leaf /plant) in T₉ (RDN+PSAP @4g/l). The similar trends were also observed for tobacco caterpillar and YVM, respectively. (Table 4) The lower infestation of Girdle beetle (0.92 mrl) was found in T₂(RDF+PPM+PSAP@4g/l) while higher in T₉ (2.40 mrl), may be due to higher vegetative foliage by application of nitrogen. The green semilooper (0.69 mrl) was observed significantly less incidence in T₂, as compared to T₉. The percentage of pod damage

(4.15) was minimum inT₂(RDF+PPM+PSAP) while maximum (8.84) in T₉. The slightly higher population of natural enemies *i.e.*, Coccinella, (1.86) chrysoperla (1.61) and predatory spider (2.24) population were recorded in T₉ as compared to T₂. There was no any phytotoxic effect was recorded after the application of PSAP in soybean crop. It was concluded that the RDF+PPM and PSAP have slight significant impact on insect pest control in soybean crop. Result were supported by the study of Bhise *et al* (2017) and Sawant *et al* (2016) who evaluated potassium phosphate against downy mildew in grape and found it was most effective in controlling the diseases.

Effect on Quality and economic return

Pooled data of experiment revealed that application of potassium salt of active phosphorus on

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grain quality of soybean *i.e.*, trypsin inhibitor activity was higher (8.34 mg/g) in RDF+PPM+PSAP@4g/l (T2) in comparison to RDF+PPM(T1) alone, (7.44mg/g), while the reverse trend was observed in case of protein and fat percentage which were higher in T1 as compared to T2. It also observed that the net return was achieved of Rs. 2209/- in PSAP sprayed plot as compared to control plot but there was no significant difference in B: C ratio values of PSAP application which was at par in T1 and T2 (Table 4).

CONCLUSION

It was concluded that the application of RDF+PPM+PSAP@4gm/l increased growth and yield attributes as compared to yield and economic return in control. In spite of this the quality aspect of soybean was also better when applied with PSAP. As well as the insect pest and disease incidence were least in soybean crop hence achieved better yield. It may be due to appropriate nutrition of P & K nutrition of soybean which enhanced growth and yield parameters, photosynthesis metabolic process reduces the loss by stomatal opening and closing in leaves of plant system.

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Received on 23/9/2022

Accepted on 18/4/2023