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Effect of Different Agro Chemicals on Growth, Development and Yield of Soybean (*Glycine max* (L.) Merril) under Rainfed Conditions

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A B S T R A C T

Soybean (*Glycine max* (L.) Merril) is an important crop and it contains 40 percent protein and 20 percent edible oil, besides minerals and vitamins. The area in Madhya Pradesh under soybean is 6.26 million hectares with the production of 5.95 million tonnes. Although, the ecological conditions of the state are congenial for soybean production, however, the average yield is substantially low (950kg/ha), despite of follows all possible management practices (SOPA, 2014). Therefore, a field experiment conducted at experimental area of AICRP for dry land agriculture, Kuthulia farm, College of Agriculture, Rewa (M.P.) during *Kharif* season2015. A total of eight treatment combinations, consisted of T1: Control, T2: two spray of water at 25-30 and 55-60 DAS, T3: two foliar spray of 1% KnO_3 solutions at 25-30 and 55-60 DAS, T4: two foliar spray of 1% KCl at 25-30 and 55-60 DAS, T5: two foliar spray of thio-urea@ 250g/ha at 25 and 55 – 60 DAS and in 500 liter of water at 25-30 and 55-60 DAS, T6: spray of thio-urea @ 250g/ha at 25 and 55 – 60 DAS and trizophos insecticide@ 600 ml/ha T7: spray of 1% KClat 25-30 and 55-60 DAS and trizophos insecticide@ 600 ml/ha, T8: two spray of 1% KnO_3 solution at 25-30 and 55-60 DAS as well astrizophos insecticide@ 600 ml/ha. The result of study revealed that the application of 1% KnO_3 at 25 – 30 and 55 – 60 DAS followed by trizophos @ 600 ml/ha proved significantly superior closely followed by T7spray of 1% KClat 25-30 and 55-60 DASand trizophos insecticide@ 600 ml/ha with respect to crop growth, Yield attributes in terms of pods/ Plant (37.18), Seeds per pod (3.13), seed index (14.13 g) as well as yields of straw (3170.2 kg/ha) and seed yield of 1390.9 kg/ha thus it could be concluded that the spray of either 1 % KnO_3or thiourea @ 250 gm /ha at 25 – 30 and 55 – 60 DAS followed by tryzophos@ 600 ml/ha proved and additive for enhancing the yield of Soybean under rainfed areas.

Introduction

Soybean (*Glycine max* L. Merril) is one of the commercial crop of India and have multiple qualities. It contains 40 percent protein and 20 percent edible oil, besides minerals and vitamins. In Madhya Pradesh, the area under soybean cultivation is 6.26million hectares with the production of 5.95 million tonnes. Although, the ecological conditionsof the state are congenial for soybean production, however, the average yield is substantially low (950kg/ha), despite of adopted all possible management practices (SOPA, 2014). Potassium (K) considered as an essential and important nutrient for growth and development of plant. It improves the efficiency of photosynthesis and use of water. Deficiency of K creates a number of problems and exhibit many deficiency symptoms during plant growth like thin stem stunted growth etc. On the other hand, the seed treatment or foliar application of thio-urea or a combination of these have been shown a positive effective on growth, yield, net photosynthesis and nitrogen metabolism under rain fed conditions.

Application of thioureaeitheras pre-sowing seed treatment or as foliar spray, significantly increased plant height, leaf area, dry matter production and seed yield as compared to the untreated plants (Garg *et al.,* 2006).Moreover, the favourable results were obtain with the combination of seed treatment with thio urea followed by foliar spray.

The beneficial effects of thio-urea were attributed to its significant role in increasing net photosynthetic rates and the concentrations of total chlorophyll and starch in the leaves. Thiourea also played a positive role in enhancing nitrogen metabolism as it significantly increased nitrate reductase activities and concentration of soluble protein in the treated plants.

The losses in the yield due to lack of plant protection measures and it varies from 46 to 96% depending upon the type of crop plant and their variety used. The frequent application of pesticides leads to the development of resistance in the target pests. Hence, a particular pesticide has to be applied at a suitable time and dose for effective management of pests Keeping the above points in view, an experiment conducted with the object to assess the comparative performance of different agro chemicals for growth and development of soybean crop and subsequent effect on supporting system for managing biotic and abiotic stresses under rainfed conditions.

Materials and Methods

A field experiment was conducted at experimental area of AICRP for dry land agriculture, Kuthulia farm, College of Agriculture, Rewa (M.P.) during *Kharif* season2015. A total of eight treatment combinations, consisted of T1: Control,T2: two spray of water at 25-30 and 55-60 DAS, T3: two foliar spray of 1% KnO_3 solutions at25-30 and 55-60 DAS, T4: two foliar spray of 1% KCl at 25-30 and 55-60 DAS, T5: two foliar spray of thio-urea@ 250g/ha dissolved in 500 litter of water at 25-30 and 55-60 DAS, T6: spray of thio-urea @ 250g/ha at 25 - 30 and 55 – 60 DAS and followed by spray oftrizophos insecticide@ 600 ml/ha,T7:spray of 1% KClat 25-30 and 55-60 DAS. Followed by spray oftrizophos insecticide@ 600 ml/ha, T8: two spray of 1% KnO_3 solutionat 25-30 and 55-60 DAS as well astrizophos insecticide@ 600 ml/ha.

These treatments were arranged in a randomized block design with three replications. The crop variety JS-20-29 was sown on 29th June and 2ndJuly 2015 with the seed rate of 75 kg/ha at a 30 cm wide rows. Soybean crop was fertilized with 30:60:30 kg

NPK/ha as basal dose in the form of urea, single super phosphate and murate of potash, respectively. All the package of practices were followed as per the recommendations given by the university. The crop was harvested on 3rd October, manually with the help of sickles. Observations pertaining to plant population at 7 days after sowing, plant height (cm), number of leaves/plant, branches/plant at an interval of 20 days, pods/plant, seed/pod and seed index as well as yields were recorded and statistically analysed for interpretation of results.

Results and Discussion

Effect on crop growth

Data pertaining to growth parameters are given in Table1. These parameters were significantly affected due to different treatments at all the growth stages of crop.

As regards to the different treatments, it was observed that the maximum plant height of 25.5, 52.24, 74.83 cm and 76.20 cm was recorded at 20, 40, 60 DAS and harvest of crop, respectively under T8 in which two sprays of 1% KNO3 solution was done at 25-30 and 55-60 DAS and Trizophos@600 ml/ha closely followed by two foliar spray of Thiourea@250g/ha at 25-30 and 55-60 DAS +Trizophos@600 ml/ha. The number of leaves and branches/plant increased with the advancement of crop age. However, the maximization of leaves (20.74 and 18.53) and branches (3.65 and 4.31) /plant were recorded at 40 and 60 DAS respectively. Further advancement in age of crop plant from 40-60 DAS the leaves/plant decreased.

The treatment given to the experiment had significant effect on both the growth parameters viz., number of leaves as well as branches/plant. The highest counts of leaves (20.74%) and branches (4.31) were recorded under T8 closely followed by T7 and T3. These findings are in close conformity with the finding of Bly *et al.*, (1990), Ramesh and Thirumurugan (2001) and Reddy *et al.*, (2004).

Effect on yield attributes

Yield attributes viz. pods/plant, seeds/pod and seed index were found significantly differ due to different treatments. The maximum values of yield attributing traits viz. No of pods (37.18 / Plant) No of seeds (3.13 / pod) and seed index (14.13 g) were recorded under T8. Whereas, the lowest counts of pods/plant (23.60/plant)seeds/pod (2.40/pod) and seed index of 12.68g were recorded under control treatment.

The treatment T8, T6 and T3 found to be at par with each other for the number of pods/plant. Whereas, the treatments T6 and T8 in number of seeds/pod, T8, T7, T6 and T5 were found to be at par with each other for seed index. The spray of 1% KNO3 as well as Trizophos at critical period of crop provide a better growth and protection to the plant might have better development of yield attributes. Similar results have also been reported by Sindhe and Jadhav (1995) and Rahul and Parth (2015).

Effects on yield

Production of grain is a complex phenomenon which is not only depends on genetic constitution of plant but also on the production measures followed. Yields data presented in Table 2 and showed that the highest seed and straw yields of 1390 kg/ha and 3170 kg/ha were recorded under T8 (spray of 1% KNO3 twice at an interval of 25-30 days subsequently spray of Trizophos @ 600 ml/ha) proved superior over other treatments.

Table.1 Effect of Treatments on Plant height, No. of leaves and branches per plant at different stages of crop growth

Treatment	Plant height (cm)				Number of Leaves / plant			Number of Branches/ plant		
	20 DAS	40 DAS	60 DAS	At harvest	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T_1: Control	22.27	45.66	65.55	66.92	7.09	16.01	13.80	2.12	2.92	3.57
T_2: Two spray of water at 25-30 and 55-60 DAS	23.70	48.58	69.64	71.00	7.42	16.87	14.67	2.26	3.06	3.70
T_3: Two foliar spray of 1% KnO_3 solutions at 25-30 and 55-60 DAS	24.13	49.46	70.94	72.31	7.92	19.34	17.47	2.39	3.43	4.08
T_4: Two foliar spray of 1% KCl at 25-30 and 55-60 DAS	23.80	48.78	69.97	71.34	8.42	17.77	15.9	2.64	3.19	3.84
T_5: Two foliar spray of thio-urea @ 250g/ha at 25 and 55 – 60 DAS and in 500 liter of water at 25-30 and 55-60 DAS	23.63	48.43	69.42	70.79	7.76	18.02	15.82	2.43	3.23	3.85
T_6: Spray of thio-urea @ 250g/ha at 25 and 55 – 60 DAS and trizophos insecticide@ 600 ml/ha	25.07	51.37	73.68	75.05	8.09	18.44	16.23	2.50	3.30	3.95
T_7: Spray of 1% KClat 25-30 and 55-60 DAS. and trizophos insecticide@ 600 ml/ha,	24.30	49.79	71.32	72.68	8.52	19.40	17.20	2.64	3.44	4.10
T_8:Two spray of 1% KnO_3 solution at 25-30 and 55-60 DAS as well as trizophos insecticide@ 600 ml/ha.	25.50	52.24	74.83	76.20	9.09	20.74	18.53	2.85	3.65	4.31
SME ±	0.56	0.87	1.12	1.44	0.38	0.68	0.51	0.12	0.13	0.13
CD (5 %)	1.73	2.68	3.47	4.47	1.16	2.12	1.57	0.39	0.40	0.41

Table.2 Effect of treatments on yield attributes and yields of Soybean

Treatment	No. of pods per plant	No. seeds per pod	Seed Index (g)	Seed yield (Kg/ha)	Straw yield (Kg/ha)
T_1	23.60	2.40	12.68	679.65	2371.1
T_2	29.98	2.53	12.78	904.76	2876.6
T_3	34.22	2.65	13.07	1049.1	3390.4
T_4	32.30	2.63	13.40	1018.8	2932.2
T_5	29.99	2.57	13.53	952.38	2975.9
T_6	35.51	3.20	13.46	1356.4	2954
T_7	33.32	2.73	13.66	1089.5	3145.9
T_8	37.18	3.13	14.13	1390.9	3170.2
SME ±	1.50	0.13	0.29	8.11	17.32
CD 5 %	4.65	0.39	0.88	25.12	13.68

Whereas, the lowest yield of 679.65 and 2371 kg/ha were recorded under control plots. This is might be due to the severe competition for nutrients right from establishment of crop uoto the end of crop growth. It leads to poor growth and development resulted in poor development of yield attributes under control plot. Whereas, treated plots(T7 and T8) attended lush growth due to better nutrition and elimination of insect incidence resulted in better development of yield attributes and consequently the higher yield. The result are in close agreement with the findings of Govindan and Thirumurugan (2000).

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