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Growth, yield, disease and pest incidence in soybean under different sowing methods and IPM practices in *Vindhya plateau* of Madhya Pradesh

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Abstract
An experiment was conducted at Agricultural Science Centre Sagar, Madhya Pradesh during *kharif* 2014-15 to 2016-17 to evaluate the impact of the sowing methods and integrated pest management practices on yield, disease and pest incidence in soybean. The results revealed that the broad bed furrow (BBF) sown soybean resulted remarkably higher plant height, no. of root nodules/plant, no. of branches/plant, no. of pods/plant, no. of seeds/pod, seed index, seed and straw yield (50.2 cm, 18.15, 3.24, 41.5, 3.35 12.34 g, 1510 kg/ha and 2.31 t/ha) respectively in comparison to other sowing methods. Among the IPM practices, these parameters were highest in IPM-1 followed by IPM-2 over control. Maximum (10.8 and 9.2%) and minimum (6.5 and 4.6%) foliar and root rot disease incidence was noted in flatbed planted soybean and BBF sown crop respectively. Minimum incidence of foliar and root rot disease was observed under the treatment IPM-2 as compared to control plot. Minimum girdle beetle, semilooper and pod borer infestation was recorded in BBF sown crop; however these were lowest in IPM-2 among the IPM practices except pod borer which recorded lowest in IPM-1. Highest net return was recorded in BBF planted soybean and IPM-1 with the incremental net return of Rs. 13155 and 19250/ha respectively.

Keywords: sowing methods, IPM, seed yield, foliar, root rot disease

Introduction
Soybean [*Glycine max* (L.) Merrill] is a legume species belongs to the family Leguminosae and sub family Papilionideae, grown mainly in *Kharif* season in Madhya Pradesh. Soybean is classified more as an oilseed crop than as a pulse. It contains 40-42% of proteins and 18-20% of oil. Soybean accounts for 30 per cent and 21.3 per cent of total production and area under oilseeds in the country. In India it is cultivated in 106.95 lakh ha with the annual production of 126.7 lakh MT out of which Madhya Pradesh contributes 58.1 lakh ha with production of 66.8 lakh MT at the productivity level of 1.15 t/ha (Anonymous 2018) [1].

There are many factors limiting the soybean production and productivity. Among these are inappropriate sowing methods, inadequate nutrient and pest management practices and moisture stress at critical crop stage are the major liming factors. The sowing of high potential yield of soybean cultivars at optimum planting method is considered as a hopeful approach to increase soybean production. Generally, the planting method varies depending on the field condition of the region and the cultivar to be grown. The broad bed furrow was also found to reduce seed rate and provided favorable environment for the growth and development of the soybean crop under rainfed condition (Ram and Kler 2007) [12]. During *Kharif* season, if heavy rains occur just after sowing carried out either by broadcast or seed drill, the seeds get deteriorated. To overcome this problem, by placed the seed on the ridges and bed through furrow irrigated raised bed planter which allow draining of the excess water and furrows conserve the moisture against the less precipitation for optimum plant population and their growth. Rhizoctonia root and stem rot, caused by the fungus *Rhizoctonia solani*, is an important disease of soybean. The disease causes heavy mortality of soybean in suitable climate. The root rot pathogenic fungi are major threat for this crop as these attacks on the root of the plant and destroy the proper functioning of the plant by disturbing the absorption of water and nutrients. Recently expansion of soybean area but their productivity was very poor against the yield potential of variety due to heavy infestation of insect and pest. Due to dominancy of mono cropping of soybean in the same field and non-adoption of suitable integrated disease management modules cause heavy loss due to buildup of many insect, pest and diseases, which become a foremost limiting factor in soybean productivity in recent years.

Overcome of this problems by integration of cultural practices i.e. summer ploughing, application of microbial antagonists (*Trichoderma viride*) and use of fungicide may be effective tool for the management. Keeping in view the above, the present investigation was carried out to evaluate the integrated pest management for reduce the infestation of pest and maximization of soybean yield and profit/unit area by suitable sowing method.

Materials and Methods

An experiment was conducted at Agricultural Science Centre, Sagar, Madhya Pradesh in *kharif* season of 2014-15, 2015-16 and 2016-17 under rainfed condition on medium black soil with medium fertility status. The experiment laid in split plot design with three sowing methods as main plot and three integrated pest management (IPM) practices as sub plot treatments with three replications. The area of each treatment was kept 0.10 ha. The soil of the experimental site was clay loam. The soil physico-chemical properties i.e pH, electrical conductivity (EC), organic carbon (OC), available N, P & K were 7.4, 0.28 dS/m, 0.68%, 252, 14.4 and 370 kg/ha respectively. Three sowing methods i.e. sowing on flatbed by seed cum ferti-drill, furrow irrigated raised bed (FIRB) and broad bed furrow (BBF) and three IPM practices i.e. control (check plot), IPM-1 (summer ploughing, soil treatment with *Trichoderma viride* @ 2.5 kg/ha and seed treatment @ 10g/kg seed, spray of clorantraniprole 20 SC @ 100 ml/ha + imazethapyr 10% SL @ 100 g a.i./ha at 25-30 DAS followed by pre-mix fungicide carbendazim 12% + mancozeb 63% WP @ 750 g/ha), IPM-2 (summer ploughing, soil treatment with *Trichoderma viride* @ 2.5 kg/ha, seed treatment with pre-mix fungicide carboxin 37.5% + thiram 37.5% WS @ 2 g/kg seed, spray of thiacloprid 21.7% SC @ 650 ml/ha, followed by thiophanate methyl 70% WP @ 600 g/ha) were assessed in three replications. Soybean variety JS 93-05 sown on 02 July 2014, 4 July 2015 and 4 July 2016 as per the three abovementioned sowing methods using 75 kg of seed/ha. Recommended dose of N: P_2O_5:K_2O @ 20:60:40 kg/ha were applied through diammonium phosphate (DAP) and muriate of potash (MOP) based on soil test value. One hand weeding was done at 35 DAS for effective control of weed. The crop was harvested between October 08 to 15 every year after the leaves turn yellow and started dropping. The data recorded from ten randomly selected plants of each treatment of each replication. The data on germination, yield attributes, seed index, seed yield, straw yield, disease incidence and insect population was recorded in each treatment; net return, incremental net return and benefit cost (B:C) ratio was analyzed to realize the economics of the treatments.

Results and Discussion

Yield attributes and productivity

Growth and yield parameters i.e. plant height, no. of nodules/plant, no. of branches/plant, no. of pods/plant, no. of seeds/pod, seed index, seed and straw yield were maximum under broad bed furrow sowing method (50.2 cm, 18.15, 3.24, 41.5, 3.35 12.34 g, 1510 kg/ha and 2.31 t/ha) followed by FIRB (48.6 cm, 17.03, 3.18, 36.7, 3.22, 12.16g, 1510 kg/ha and 2,31 t/ha) over flatbed planting by seed cum ferti-drill (47 cm, 15.86, 3.09, 27.4, 2.93, 9.24 g, 1077 kg/ha and 1.53 t/ha) respectively. Kaur (2003) recorded better soybean seed yield under raised bed planting than flat planting at Ludhiana. Ram *et al.* (2011) [12] also found the similar findings in their study where they recorded the highest seed yield in raised bed sowing, which was 6.70 and 5.29% higher than ridge-furrow and flatbed sowing methods respectively. These findings are also in agreement with those of Kang *et al*. (2012) [6]. Jha and Soni (2013) [5] recorded highest yield of soybean in Broad Bed Furrow sowing method (1.47 t/ha). Among the integrated pest management practices, highest plant height, root nodules/plant, branches/plant, pods/plant, seeds/pod seed index, seed yield and straw yield was recorded in IPM-1 which was 47.6 cm, 18.97, 3.18, 44.5, 3.41, 12.38 g, 1580 kg/ha and 2.4 t/ha respectively followed by IPM-2, whereas these parameters were found lowest in control due to high incidence of disease and insects. Pods/plant and seed yield was significantly high in IPM-1 and IPM-2 than that of check plot (control). Dass *et al*. (2017) [3] reported that application of rynaxypyr 20 SC @ 100 ml/ha + imazethapyr 10 SL @ 1.0 l/ha performed best in terms of lowering pest infestations.

Effects on disease and insect incidence

The crop sown by BBF method registered remarkably higher germination percentage (73%) however it was lowest in flat bed sown plots (68%). Among the IPM practices the germination percentage was significantly high in IPM-1 (74%) over control (66%). Kang *et al.* (2012) [6] reported that bed planted soybean with or without mulch recorded higher growth and yield attributes, seed and straw yield as compared to conventional and zero tillage planting method. Among the sowing methods, highest foliar and root rot disease incidence was recorded under flatbed sown crop (10.8 and 9.2%) and lowest (6.5 and 4.6%) in BBF method of sowing. Under the IPM treatments, occurrence of foliar and root rot disease was 7 and 6 per cent in IPM-1 (*Trichoderma viride* amended plots and seed treatment by same), however 6 and 1.8 per cent in IPM-2 (soil treated by *T. viride* and seed treatment by carboxin+ thirum) over control (12 and 9.8 per cent). Konde *et al*. (2008) [8] also reported the effectiveness of *T. viride* and *T. harzianum* against collar rot and root rot diseases of soybean. The genus *Trichoderma* comprises of a large species complex having potential as bio-control agents against *R. solani*. *Trichoderma* isolates can parasitize hyphae, sclerotia and other structures of *R. solani*. The metabolites of *Trichoderma* spp. induce competitiveness against the pathogen and induce resistant to host plant (Abbas *et al*. 2017) [2]. Maximum girdle beetle, semilooper and pod borer infestation was recorded in flatbed planted soybean which was 3.8/m^2, 1.3/plant and 1.5/m row length respectively and the lowest in BBF sown crop which was 2.2/m^2, 0.9/plant and 1.2/m row length respectively but the difference was non-significant. Both the IPM practices, IPM-2 resulted lowest girdle beetle and semilooper infestation (1.8/m^2 and 1.2/plant) however pod borer infestation was lowest in IPM-1 (1.1/meter row length) over control. Singh *et al*. (2013) reported that application of *Trichoderma viride* managed the soil borne diseases in soybean and increased average yield by 18.2 per cent and net return by 31.6 per cent over farmers' practice. Patil *et al.* (2014) [10] found the best performance of chlorantraniliprole 18.5 SC @ 30g a.i./ha in protecting the soybean crop from the infestation of lepidopteran pests. Kulchan *et al.* (2019) [9] reported the best performance of *Trichoderma viride* in controlling seedling mortality due to collar rot by 0.61% and the incidence of rhizoctonia arial blight disease by 0.34% in comparison to control (9.8% and 9.17%).

Economics of soybean under different sowing methods and IPM

It is evident from the data given in table-3 that net return and

B:C ratio was high with the BBF sowing method which recorded to be Rs.37850/ha and 3.52 respectively over the other sowing methods of soybean. Jain and Dubey (1998) [4] reported higher net return with BBF sowing of soybean. Jha and Soni (2013) [5] reported that the BBF sowing method of soybean gave maximum net monetary returns of Rs.16584/ha and B:C ratio (1.87). Ram *et al*. (2011) [12] reported that net monitory return and B:C ratio were highest in raised bed sowing method which were significantly higher than ridge furrow and flat-bed sowing methods. Among the IPM practices, IPM-1 resulted higher net return (Rs.41100/ha) and B:C ratio (3.89) over the other pest management practices. Rs.19250 and 11825/ha incremental net return was recorded in IPM-1 and IPM-2 respectively over control. The control plot reflected lowest net return (Rs.21850/ha) and B:C ratio (2.61) due to lowest seed yield (1010 kg/ha) of soybean.

Table 1: Yield attributes and productivity of soybean as influenced by sowing methods and IPM practices (pooled mean of three years)

Treatments	Plant height (cm)	Root nodules/ plant	Branches/ plant	pods/ plant	Seeds/ pod	Seed index (g)	Seed yield (kg/ha)	Straw yield (t/ha)
Sowing methods								
Flatbed	47	15.86	3.09	27.4	2.93	9.24	1077	1.53
FIRB	48.6	17.03	3.18	36.7	3.22	12.16	1352	2.04
BBF	50.2	18.15	3.24	41.5	3.35	12.34	1510	2.31
LSD (P=0.05)	NS	NS	NS	7.18	NS	NS	36.9	NS
IPM practices								
Control	46.8	15.64	3.07	27.2	2.9	9.13	1010	1.48
IPM-1	47.6	18.97	3.18	44.5	3.41	12.38	1580	2.40
IPM-2	47.4	17.12	3.16	38.2	3.24	12.21	1385	2.07
LSD (P=0.05)	NS	NS	NS	7.52	NS	NS	32.8	NS

Table 2: Germination, disease incidence and insect infestation under different sowing methods and IPM practices in soybean (pooled mean of three years)

Treatments	Germination (%)	Foliar disease incidence (%)	Root rot disease incidence (%)	Insect infestation		
				Girdle beetle (No./m^2)	Semilooper (No./plant)	Pod borers (No./m row length)
Sowing methods						
Flatbed	68	10.8	9.2	3.8	1.3	1.5
FIRB	71	7.1	5.8	3.1	1.1	1.3
BBF	73	6.5	4.6	2.2	0.9	1.2
LSD (P=0.05)	NS	NS	NS	NS	NS	NS
IPM practices						
Control	66	12.0	9.8	3.2	1.9	2.2
IPM-1	74	7.0	6.0	2.1	1.4	1.1
IPM-2	71	6.0	1.8	1.8	1.2	1.2
LSD (P=0.05)	6.98	NS	NS	NS	NS	NS

Table 3: Economics of soybean cultivation under different sowing methods and IPM practices (pooled mean of three years)

Treatments	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Incremental net return (Rs/ha)	B:C ratio (Rs/ha)
Sowing methods					
Flatbed	13000	37695	24695	-	2.89
FIRB	14500	47320	32820	8125	3.26
BBF	15000	52850	37850	13155	3.52
IPM practices					
Control	13500	35350	21850	-	2.61
IPM-1	14200	55300	41100	19250	3.89
IPM-2	14800	48475	33675	11825	3.27

Conclusion

Based on the above findings it is concluded that FIRB and BBF sowing of soybean should be promoted over flatbed sowing for getting higher seed and straw yield. Further this study indicates that by adopting the IPM practices the labour requirement reduced because of combined application of herbicide and insecticide. Thus, the FIRB and BBF sowing methods; and IPM practices sizably raise the productivity and net return with reduction in labour requirement, pest and disease infestation.

References

1. Anonymous. The Soybean Progress Association of India, 2018. www.sopa.org
2. Abbas A, Jiang D, Fu Y. *Trichoderma* spp. as Antagonist of *Rhizoctonia solani*. Journal of Plant Pathology & Microbiology. 2017;8:3.
3. Dass A, Dey D, Lal SK, Rajanna GA. Tank-mix insecticide and herbicide application effects on weeds, insect-pest menace and soybean productivity in Semi-Arid Northern Plains of India, 2017. Legume Research DOI: 10.18805/LR-3855
4. Jain MP, Dubey AK. Productivity and economic viability of soybean with respect to planting systems and cultivars in vertisol. Crop Research. 1998;16:102-22.
5. Jha AK, Soni M. Weed management by sowing methods and herbicides in soybean. Indian Journal of Weed Science. 2013;45(4):250-252.

6. Kang JS, Singh A, Kaur M. Studies on growth and yield of soybean (*Glycine max* L. Merrill) under different planting methods and fertility levels. Legume Research. 2012;35(3):265-267.
7. Kaur M. Studies on seed rate, irrigation, weed control and their interactive effects in raised bed planted soybean. Ph.D. thesis. Punjab Agricultural University, Ludhiana, India, 2003, 230.
8. Konde SA, Raut BT, Panzade DS, Ingle SH. Management of root/collar rot disease in soybean. Journal of Plant Disease Sciences. 2008;3(1):81-83.
9. Kulchan MK, Ansari MM. Efficient application of *Trichoderma viride* on soybean seed using thin layer polymer coating. Legume Research. 2019;42:250-259.
10. Patil MV, Kulkarni AV, Omkar G. Evaluating the efficacy of novel molecules against soybean defoliators. The Bioscan. 2014;9(2):572-580.
11. Ram H, Kler DS. Growth analysis of soybean [*Glycine max* (L.) Merrill.] and wheat (*Triticum aestivum* L. emend. Fiori and Paol) in sequence under no tillage and permanent raised bed planting. Indian Journal of Ecology. 2007;34:154-157.
12. Ram H, Singh G, Agrawal N, Kaur J. Soybean (*Glycine max*) growth productivity and water use under different sowing method and seeding rate in Punjab. Indian Journal of Agronomy. 2011;56(4):377-380.
13. Singh RK, Singh SRK, Singh TK, Gautam US, Dixit AK. Yield performance of soybean in Vindhyan Plateau of Madhya Pradesh. Soybean Research. 2013;11(1):66-73.