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Impact of sweep seed drill on soybean production under vulnerable climatic condition of Madhya Pradesh.

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ABSTRACT:

Rainfall and its distribution pattern has exhibited frequent aberrations with extreme situation of sudden downpour or long dry spells entailing into severe stress on soybean crop during critical growth stages results into reduction of yield. Keeping the above facts in view, the In-situ rain water conservation techniques for minimizing risk of crop failure and stabilizing soybean crop was implemented using tractor drawn sweep seed drill facilitating weeding along with sowing operations in the field prepared for soybean crop. Further, KVK Panna has made consistent efforts to popularize the improved sowing method with soybean variety JS 97-52 and JS-9305 along with other production practices for enhancing yield of soybean and income of farmers. The present study deals with enhancement of soybean production through replacement modified/sweep seed drill and improved variety, which showed 6.8 per cent area has been occupied with improved sowing methods along with improved soybean variety 'JS 97-52 and JS-9305' in the district with an increase in yield by 48.3 percent and net returns by 64.8 per cent over traditional sowing method. Use of sweep seed drill at farmer's field resulted as 16.47 q/ha as compared to flat/broad casting sowing method 11.2 q/ha. The highest B C ratio was recorded 2.7 under sowing method of sweep seed drill as compared to flat sowing method 2.0. This drill also helped in saving the soil moisture through increased infiltration rate of rain water and reduced runoff that leads slow rate of soil erosion too.

KEYWORDS: Yield, Economics and Horizontal spread of technology.

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INTRODUCTION:

Soybean (Glycine max L. Merrill) is an important leguminous oilseed crop which plays a very vital role in strengthening the Indian economy. Soybean is a good source of vegetable oil and protein and

has become the integral component of humen diet. The area and production under soybean cultivation in India is estimated to be around 11.0 million ha and 11.5 million metric tons. Madhya Pradesh is the leading state with first rank in the area (5.6 million ha) and production (3.4 million tons) of soybean crop Anonymous (2016-17). The district Panna which is situated in Kymore Plateau & Satpura hills zones of Madhya Pradesh, Which are geographically suited lies between 23^0, 45' N and 25^0 , 10' N latitudes and 75^0 , 45' E and 80^0 , 40' E longitudes. This zones also witnessing the soybean crop as an emerging important kharif crop of the district. In Panna district, the area under soybean cultivation is 28500 ha and the productivity is 1110 kg/ha during 2017-18 however, lesser than the yield potential (1800-2000 kg/ha) of the crop. Because the climate change since last two decades has brought out the changes in rainfall pattern and distribution which exhibited aberrations either as sudden downpour or long dry spells during kharif season that poses severe stress on soybean crop and reducing the grain yield similar result were also noted by Ralli and Dingra (2003).. In view of this, in- situ rain water management strategies for minimizing risk of crop failure and stabilizing soybean production was felt. In this regard, Krishi Vigyan Kendra Panna introduced sweep seed drill, a modification in the traditional seed drill which makes ridge and furrow. In this modified seed drill, the seed is covered by the pulverized soil that makes the ridges and the furrows which allow draining of the excess water and conserve the in- situ soil moisture under less precipitation regime through increased infiltration rate and reduced run-off.

In this modified method of sowing, 70 kg seeds/ha is required while in line sowing/broadcasting method of sowing farmers using 100-110 kg seeds/ha, even though they were not able to obtain desirable plant population thus, 30-40 kg seed is saved. Fewer labourers are also required for the control of weeds and insect pests as well as for harvesting. Thus, this technology reasonably brings down the demand of laboures (20-25%) and inputs (12-15%) as it reduces the infestation of weeds and insect pests from cited by Singh et.al (2012). This modified seed drill does not require high power tractor and the cost of implement in also not expensive hence easly acceptable to large number of farmers.

MATERIAL AND METHODS:

Krishi Vigyan Kendra Panna introduced Sweep seed drill, a modification in the traditional seed drill, manufactured by Directorate of Soybean Research, Indore, Madhya Pradesh, through front line demonstrations of varietal performance, which also make ridge and furrows. The modification in traditional seed drill was made by replacing tines through attaching the shovel and stopped of the every out let of back tines from seed drill. This modified seed drill maintains row to row spacing (45 cm) which is recommended for the soybean crop. The modified seed drill was introduce at farmer's field during kharif 2009-10 included use of improved variety JS 9752, balanced dose of fertilizers (20:60:20 NP_20_5K kg/ha) based on soil test values and seed treatment with fungicide (Carbendazim + Thiram @ 1+2 g/kg seed) followed by seed inoculation with Bradyrhizobium japonicum and phosphorus solubilizing bacteria (PSB) @ 5 g per kg seeds each and one spray of imazethapyer @ 1 litre per ha at 15 days after sowing for weed management. The performance of the crop was compared with the farmer's practice on the same location, which included use of only

50 kg DAP per ha, higher seed rate (125 kg/ha) and sowing of seeds without seed treatment with fungicides and biofertilizers. The Soybean crop was sown between second fortnights of June and harvested during last week of September to first week of October. The seed rate of improved variety of soybean (JS 9752) was used @ 70 kg per ha. Soil test based tailored NPK fertilization was applied as basal form. The crop was protected from insect-pests and diseases as per recommendation. The yield data from demonstration field and farmer's crop was collected time to time after harvesting the crop. In subsequent year (2017-2018), the horizontal spread of the sowing methods of modified seed drill with improved variety (JS 9752 & JS 9305) in the District was made through frequent farmers contact, interface with farmers, training to farmers and Rural Agricultural Extension Officer (RAEO), Krishak Sangosthi and field days about good yield attributes of the crop. In addition, the some progressive farmer also disseminated the information about modified seed drill along with improved variety among the farming community through personal contact in subsequent years of study. For economic evaluation in term of gross and net return and cost benefit ratio, the prevailing rates for input, labour and produce was utilized.

RESULT AND DISCUSSION:

Field performance

The results clearly revealed that sowing method affects the growth and yield of soybean crop. Maximum growth and yield of soybean crop was recorded from modified seed drill sown crop than the broadcasting sown crop. The growth parameters such as plant height, number and size of nodules per plant were recorded higher from modified seed drill sown crop than the broadcasting. The yield parameters such as number of pods per plant, number of grains per pod and test weight were also recorded higher under modified seed drill sowing crop than the broadcasting. Maximum yield was obtained from the modified seed drill sown crop (16.47 q/ha) than the broadcasting (11.2 q/ha) (Table 1). It is clearly evident from the economic analysis that maximum gross return (Rs. 45600/ha), net return (Rs.29100/ha) and B: C ratio (1:2.7) was obtained from modified seed drill sowing crop than the broad casting (Rs. 33300/ha), (Rs. 17654/ha) and (1:2) respectively (Table 2). Because soybean crop sown with modified seed drill is attributed to appropriate cover of seeds by well pulverized soil that allow abundant quantity of moisture and oxygen to the seeds for proper germination and growth of seedlings Similar results were reported by Senapati et al.(1988) and Smith et al. (1994), Harrigan and Smyrillis (2000), Singh et.al.(2012). This sowing method not only conserves the soil moisture for plant growth but also drain out the excess water without causing soil erosion Singh et.al.(2012) and Singh et.al (2015) . In addition, the furrow act as in-situ soil moisture conservation hence mitigates the detrimental effects of dry spell to the crop similar result were also noted by Ralli and Dingra (2003). As the plants get almost equal chance for nutrient and moisture absorption for their growth which results in uniform growth of plants that leads greater seed size which contributed higher yields and higher income (Lakpale and Tripathi 2012).. Therefore, maximum crop growth and grain yield of soybean was obtained where seeds were sown with modified seed drill as compared to broadcasting method.

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Refinement of Technology:

This technology was already refined from traditional seed drill to use in the place of furrow irrigated raised bed planting system. The modification in traditional seed drill was made by attaching the shovel in the rear tines along with plugging of all rear outlets of the seed drill in the place of Furrow irrigated raised bed planter. Because farmers are not adopting furrow irrigated raised bed planter in soybean cultivation due to several reasons which are described below. Generally farmers having low power tractors while this implement require high power tractor. In addition high cost of implement makes it out of reach to marginal and small farmers, however, subsidy is being given by the Government but it does not significantly influence the farmers to purchase this implement. Apart from these smooth ridge and furrow can only be formed in those fields where summer deep ploughing has been done by reversible mould board plough which it is not being followed by farmers.

Table - 1 Effect of sowing methods on growth and yield of soybean crop.

Treatment	No. of Nodules/ plant	Size of Nodule (mm)	No. of pods/plant	No. of grains/pod	Test weight (g)	Yield (q/ha)
Broad casting	56.0	5.0	15	2.8	107	11.2
Modified seed drill	60.5	5.5	17	3.0	109	16.47

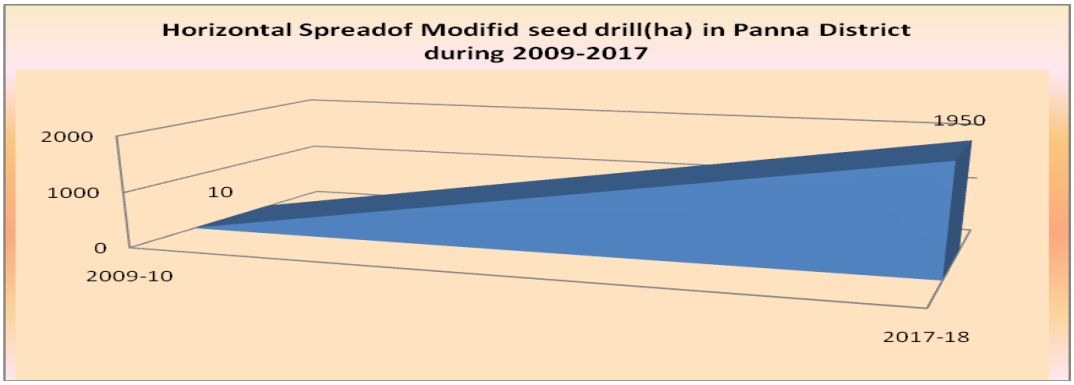
Table - 2 Economic evaluation of improved production technology

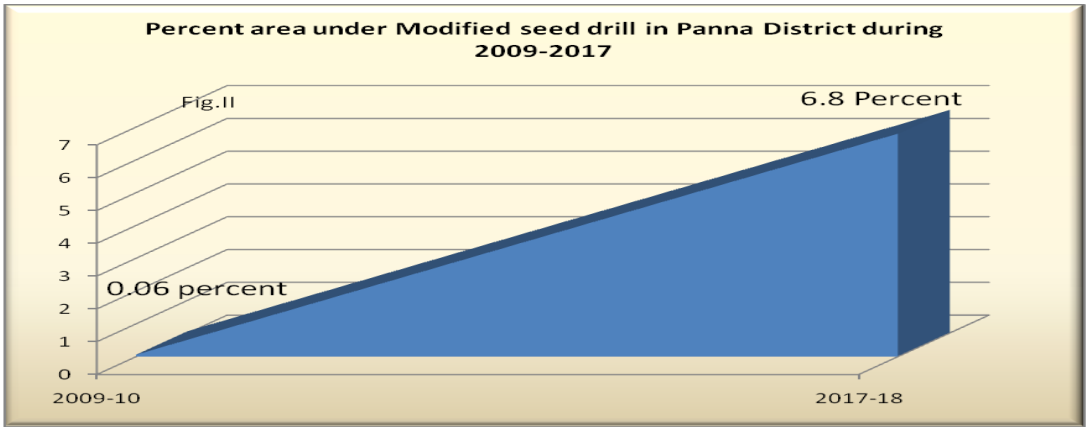
Treatment	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
Broad casting	15646	33300	17654	1:2.0
Modified seed drill	16500	45600	29100	1:2.7

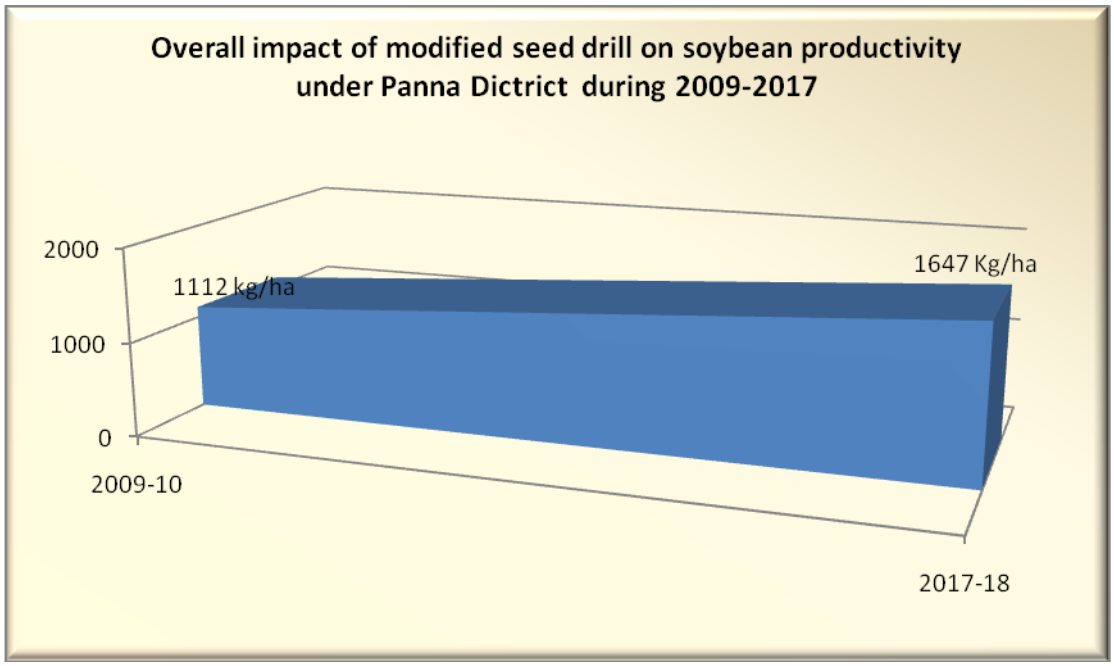
Table 3. Horizontal Spread of modified seed drill technology in Panna District.

Year	Horizontal Spread (ha)		Horizontal Spread (%)		Average yield (kg/ha)	
	Modified seed drill	Traditional sowing practices	Modified seed drill	Traditional sowing practices	Modified seed drill	Traditional sowing practices
2009-10	10	14500	0.06	99.9	1550	1100

2010-11	70	16000	0.44	99.6	1590	1110
2011-12	160	16500	0.99	99	1840	1155
2012-13	390	19000	2.1	97.9	1830	1150
2013-14	550	20500	2.7	97.3	1550	1105
2014-15	670	21000	3.1	96.9	1550	1105
2015-2016	880	21636	4.1	95.9	1750	1123
2016-17	1340	27600	4.8	95.2	1620	1050
2017-18	1950	28500	6.8	93.2	1540	950
Mean	-	-	-	-	**1647**	**1112.2**







Outcome:

In this modified method of sowing, 70 kg seeds/ha is required while in broadcasting method of sowing farmers using 100-110 kg seeds/ha, even though they were not able to obtain desirable plant population thus, 30-40 kg seed is saved. Fewer labourers are also required for the control of weeds and insect pests as well as for harvesting. Thus, this technology reasonably brings down the demand of laboures (20-25%) and inputs (25-30 %) as it reduces the infestation of weeds (59.91– 68.37%) and insect pests from cited by Singh et.al (2012). In addition, this modified seed drill does not require high power tractor and reversible mould board plough for making ridge and furrow. The cost of modified seed drill is also not expensive hence easily acceptable to large number of farmers.

Impact of technology:

The achievements and outcome of modified seed drill are outstanding. Soybean has registered significant increase in productivity and returns per rupee investment. The average yield of improved variety (JS 97-52, JS-9305) of soybean has exhibited average 48.7 per cent increase in yield under this technique against to farmers sowing method (Broad casting/line sowing) with locally cultivated varieties (Fig III). This is primarily due to introduction of modified seed drill along with high yielding and disease resistant variety with improved technology against farmer practices. During 2009-10 to 2017-18, the horizontal spread of the modified/sweep seed drill increased by 6.8 per cent (Fig.II). Out of 28500 ha area under soybean crop in the District, under modified seed drill sowing technique occupied around 1950 ha (Table 3 and Fig. I). Before adoption of modified/sweep

seed drill farmer was harvested an average production of soybean of 950-1,155 kg per ha, and now the same farmer is producing 1500-1647 kg per ha of soybean (Fig. III). Jat and Singh (2003) reported higher biological yield and highest net and gross return from land configuration treatment as compared to conventional system has been reported. Tomar et al. (2007) suggested that the land configuration practices such as raised-furrow bed system for normal as well as problematic soils, furrow for conserving rainwater, nutrient and soil resources are appropriate and cost effective. They found higher seed and straw yield under modified land configurations as compared to the traditional planting system. Nearly 1043.2 tones additional yield was obtained from adoption of modified/sweep seed drill with improved variety (JS- 9752 & JS -9305) in 1950 hectare area in the District. It could be possible mainly due to effective dissemination of modified/sweep seed drill with improved variety (JS 9752 & JS 9305) of soybean crop by bringing awareness among farmers and farm women along with RAEO of the village through various field oriented activities, training programme and availability of literature related to package and practices of soybean crop.

Future prospects:

This sowing method of soybean is applicable on whole district, but more beneficial where black soil was found. Because modified/sweep seed drill technology contributes in increasing soybean yield and also helps in reducing cost of production. The results show a convincing as far as economic superiority of Ridge and furrow technique over conventional method of sowing similar result was found by Singh et.al (2012), Dodwadiya and Sharma (2012). This technology is very conducive in increasing the crop production and net income, its popularity would increase day by day among the farming community and area under such technologies is expected to enhance widely in Panna district. The long-term impacts of this technology on food production, natural resources (land and water) and linkages with poverty alleviation should be further explored. The participatory research at farmers' field could play pivotal role in technology improvements and dissemination.

Feed back of soybean growers:

Adoption of modified/sweep seed drill which passes through awareness about the implements, assessment of the expected returns from the implements, the farmers may then decide to grow of soybean through modified/sweep seed drill. Good performance of the modified/sweep seed drill was observed during evaluation with the farmers. For getting feedback about the sweep seed drill approximately 105 farmers were interviewed through comprehensive questionnaire in the study area. Since this equipment save the soil moisture through increased infiltration rate of rain fall and reduced runoff that leads slow rate of soil erosion. The furrow which allows drainage of excess water in case of heavy precipitation, while serves as in situ moisture conservation during dry spells, thus mitigating the detrimental effects of excess and dry spell situation. It was found suitable in terms of increased profitability and reduced risk. The farmers decided to switch off the other sowing method & variety and adoption of this sowing method in kharif season. Scientist gain insights about the level of adoption and the underlying factors that constraint or facilitate the adoption process, it is useful to examine the factors that determine technology uptake. This

information is important to both researchers and policy makers. The researcher would gain useful feedback on the level of uptake of the technology/ variety by the soybean growers and the attributes of the technology that conditioned the level of adoption. This can be useful in decision to develop well-suited sweep seed drill variety that meets the needs of the target of increasing population in future. Policy makers can use such information to reform the policies that slower down the technology uptake or formulate and implement new instruments that hasten and support the adoption process.

CONCLUSION:

The farmers of Panna District have been sowing the improved variety (JS 97-52 and JS-9305) of soybean crop by sweep seed drill consistently since last seven years which brought out significant increase in yield of soybean crop that leads positive socio-economic changes in their life. The study also suggests that similar kind of approach can effectively convince the other farmers in other places of the District to adopt sowing method of modified seed drill and improved variety (JS 97-52 & JS-9305) with recommended package of production to optimize their productivity which may effectively contribute to increase the national production of soybean.

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