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PERFORMANCE OF SOYBEAN OVER MOLE DRAIN FIELD WITH RIDGE FURROW SYSTEM OF SOWING

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Abstarct

A field experiment was conducted during *Kharif* seasons of 2014 and 2015 at village Simariyakala at block Mohkhed of Chhindwara district of Madhya Pradesh with variety JS 95-60 on the same plots during both years. Results showed that the plant growth characters were found superior over mole drained ridge and furrow system sowing plot as compared to conventional line sowing plot which subsequently resulted in yield enhancement of soybean crop. Mole drainage is used in impermeable soils as a cost-effective means of facilitating a shallow pipe drain network. Mole drainage is suited to soils with high clay content. Practical aspects of the installation of mole drains on soils followed by ridge furrow system of sowing, in relation to slope, mole length and stability, erosion and ageing of the mole channels are considered. Tillage practices are needed to increase agronomic stability and productivity while enhancing the environment as well as yield of soybean. The results of experiment indicate that for achieving maximum productivity from soybean crop even in heavy soils in Chhindwara district of Madhya Pradesh, the soybean crop should be sown by preparing the land with Mole drain plough followed by ridge and furrow sowing system.

Key words: Ridge and Furrow, Mole drain and soybean.

Introduction

Soybean (*Glycine max)* is known as the "Golden bean" of the 21st century. Soybeans or soybean is a type of legume, native to eastern Asia. Though, soybean is a legume crop, yet it is widely used as oilseed. Majority of the area under soybean–wheat based cropping system is in Central India and is covered under Vertisols and associated soils (Bhatnagar and Joshi 1999). These soils are potentially productive, if managed properly in terms of overcoming soil, water and nutrient management constraints. Aside from water, soybeans are mainly composed of proteins, but they also contain good amounts of carbohydrates and fats. The type of tillage, plant population, row spacing, and planting date are four major management decisions that soybean farmers must consider. How individual producers choose to handle each management application depends on their own farming circumstances. The main constraints related with soybean cultivation is time and amount of rainfall, which drastically reduces the health management of soybean cultivation resulting into poor growth of plant. Sometimes it may results into complete death of whole field. A Field experiment was conducted during *Kharif* season of 2014 and 2015 to study ridge and furrow system for soybean crop with Mole drained field at 6 farmer's field. Verma (2008) conducted a field trial at College of Agriculture, JNKVV, Indore to find out the effects of various land configurations and seed rates on growth and productivity of soybean in Vertisols and reported that ridge and furrow sowing and broad bed and furrow sowing produced significantly higher growth parameters, yield and yield attributes and root parameters as well. Ridge and furrow topography was a result of ploughing with non-reversible ploughs on the same strip of land each year. It is visible on land that was ploughed. Traditional ploughs turn the soil over in one direction, with the ploughshare and moldboard to the right. The movement of soil year after year gradually built the centre of the strip up into a ridge,

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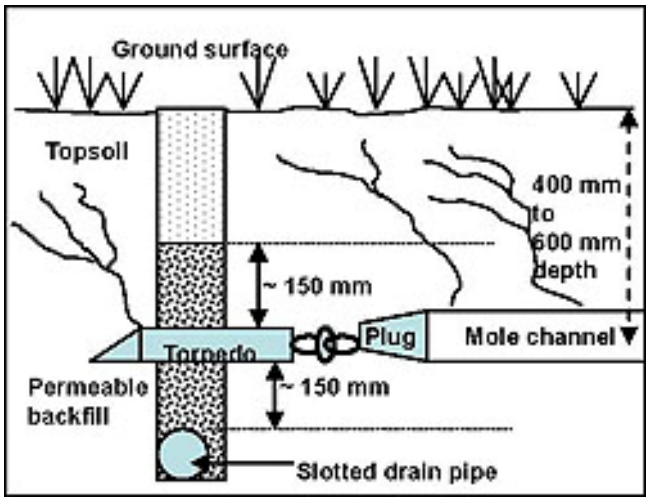
leaving a dip, or "furrow" between each ridge. The raised ridges offered better drainage in a wet climate: moisture drained into the furrows, but in case of deep black soils it is very difficult to harvest healthy soybean even in ridge furrow. So the field was prepared with mole drain also. Tomar *et al.* (2007) suggested that the land configuration practices such as raised-sunken bed system for normal as well as problematic soils, broad bed and furrow and tied furrow for conserving rainwater, nutrient and soil resources are appropriate and cost effective. Besides, other techniques the In-situ conservation of rainwater at farm level by adopting holistic approach to the management of rainwater like broad-bed and furrow, ridge and furrow, tied ridging, raised and sunken bed and compartmental bunding etc. by which crop productivity is substantially increased. The strategy for soil moisture management is therefore; to maximize use of rainfall by increasing infiltration and moisture retention, encourage surface drainage and reducing runoff and soil erosion for optimizing the performance of high yielding improved varieties through mole drain. Mole drains are used in heavy soils where a clay subsoil near moling depth (400 to 600 cm) prevents downward movement of ground water and creates retention of rain water in the field. Mole drains are a more sophisticated drainage system than open rains. Mole drains do not drain groundwater but removes excess water as it enters from the ground surface. While surface drainage can remove excess surface water, it is the soil profile itself that needs to be drained, in many situations. Mole draining can help reduce water logging problems substantially. Heavy soils with low rates of water movement need regular drainage to improve soil structure and productivity. The aim of mole draining is to fracture and crack the soil and construct unlined mole channels at consistent depth and even spacing. This allows the pastures and crops to reach their potential production and stock damage by treading and compaction to be reduced. Mole drainage is widely used in heavy soils to improve productivity of pastures and crops. Mole drainage was popular with dairy farmers in the 1960's in Victoria. Recent research has resulted in robust guidelines for installing mole drains so that they are more effective for longer up to 3 years, with a greatly reduced failure rate. Here we had used mole drainage with proper ridge furrow sowing of soybean, on the right soil type and when installed correctly, can help reduce water logging problems substantially to increase yield and to reduce the chances of insect pest as well disease attack.

Material and Methods

A Field experiment was conducted during *Kharif* seasons of 2014 and 2015 to study ridge and furrow system for soybean crop with Mole drained field at 6 farmer's field in both years respectively in Chhindwara district under Satpura plateau agro-climatic region of Madhya Pradesh, AES III with medium to deep black soils, annual average rainfall of 750-1100 mm. The experiments was conducted with 2 plots, each had an area of 1 acre as treated plot and 1 acre as conventional line sowing plot with simple seed drill sown same variety JS-95-60. Before sowing with ridge furrow system during the month of april just after harvesting of wheat from fields to use the available soil moisture of fields, fields were prepared by mole drain plough comprised of a torpedo-like cylindrical foot attached to a narrow leg, followed by a slightly larger diameter cylindrical expander. The foot and trailing expander form the mole channel while the leg creates a narrow slot that extends from the soil surface down to the mole channel depth. Mole drains were installed at an angle (often 70 to 900) to the direction of the pipes. Excess ground water flows into and along the mole drains, then drains into the porous backfill above the pipes, and is then quickly removed to outfalls via the subsurface collector pipes.

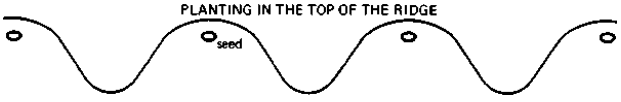
Fig 1 : Mole drains over a collector pipe system.



The action of the mole plough is to form a channel in the area of the profile with a specific clay content, yet produce upward cracking of the soil profile immediately above the mole channel. These cracks allow water flow to the mole channel. The tractor drawn attachment was ran across the selected field and made a single channel that was attached with a tank at the most downward end point of the field through a collector pipe system. The upper section of the soil profile needs to be dry enough to form cracks at the time of mole draining and the ground

surface dry enough to allow traction. If too moist then the cracks can "heal" over and reduce water intake. It is extremely preferable to have a warm drying period with no rain to allow the cracks to dry and the mole channel itself to harden. Usually when the clay at mole draining depth has a moisture content of 20 to 25 %, conditions are satisfactory. Tested the soil by kneading between the fingers. Mole draining in autumn is not recommended, as the topsoil is wet and subsoil is too dry. The subsoil is difficult to mole and to dry out and it's difficult to achieve the desirable depth. Mole channels will tend to slough off and fail. Optimum mole drain depth depends on soil type, and the conditions when moles are installed. Generally moles are pulled at 400 to 600 mm depth. Same was here in the experiments. Moles less than 400 mm deep are liable to be damaged by tractors and animals during or immediately after rain. Very heavy soils and those with high contents of suitable clay down to moling depth may benefit from its first mole draining at a shallower depth due to tractor limitations. Also as the soil structure improves over time subsequent moles can often be pulled at deeper depth. Spacing between moles was usually about 2 m in demonstrated fields. The drain outfall or outlet is the most important part of the system. If this fails the whole system fails. Mole drains can discharge to open drains, into interceptor drains filled with gravel, or preferably a collector pipe system. The suitability of any site for mole drainage must be established beforehand by means of detailed investigation. In the *Kharif* season at the time of sowing to make the ridge and furrow system an extra attachment called ridge furrow attachment provided by SADO office Mohkhed had attached on the back tines of tractor operated seed-cum-fertilizer drill machine. Sowing seeds by front line tines and covering them by soil took place by ridge furrow attachment attached in back line tines. Thus lines of soybean automatically come over ridge favoured by formation of alternate furrows. Those furrows were useful to drain out excessive rainwater during heavy storms and for storing rainwater in furrows for enriching soil moisture through percolation in case of deficit rainfall.

Fig. 2 : Ridge Furrow system of sowing.



The soil moisture thus stored sustains the crop during dry spells. This field was treated field. On the other hand second field was as untreated field, where simple line sowing had done with tractor drawn seed cum fertilizer drill. The soil conditions were same both for treated and untreated fields. The plant growth character and yield contributing data such as plant height, number of branches per plant, number of seeds per pod, weight of 100 seeds, seed yield, straw yield, were recorded for soybean crop.

Result and Discusion

The plant growth character and yield contributing data such as plant height, number of branches per plant, number of seeds per pod, weight of 100 seeds, seed yield, straw yield, of soybean were recorded in *Kharif* 2014 and 2015 as shown

Table 1 : Growth characters of soybean

S. No.	Growth characters	Mole drained ridge furrow treated plot			Conventional untreated plot		
		2014	2015	Mean	2014	2015	Mean
1.	Plant height (cm)	62.4	64.3	63.35	53.9	55.1	54.5
2.	Number of branches plant^{-1}	5.12	5.23	5.17	4.89	4.91	4.9
3.	Number of seeds per pod	2.48	2.51	2.49	2.10	2.09	2.09
4.	Weight of 100 seeds (g)	5.21	5.33	5.27	4.01	4.12	4.06
5.	Seed yield (q ha^{-1})	13.98	14.01	13.99	11.22	11.59	11.40
6.	Straw yield (q ha^{-1})	15.68	16.24	15.96	13.25	13.85	13.55

in table 1. Plant growth characters were found superior over mole drained ridge and furrow system plot as compared to conventional line sowing plot. Verma (2008) also reported that the plant population of soybean was influenced significantly due to different land configurations, he recorded significantly higher plant population under Ridge and Furrow Planting of soybean. Similar findings were obtained by Tomar *et al.* (1996) for plant population. Raut *et al.* (2000) and Autkar *et al.* (2006) reported that ridge-and-furrow sowing was significantly superior to conventional flat sowing in increasing plant height. The maximum seed as well sa straw yield of soybean was recorded when grown on mole drained ridge furrow system of planting as compared to conventional method of sowing *i.e.* flat bed sowing. However in both the years heavy continuous rainfall was recorded, due to that all the fields were not performed better even in maize also. Water stagnation conditions in the fields of *Kharif* crops of 2014 and 2015 were very harmful for all *Kharif* crops. Many fields of maize were completely vanished in 2015 due to continuous heavy rainfall. As maize is hardy crop as compared to soybean with having maximum area under cultivation of Chhindwara district. Effect of mole drained ridge furrow sowing system

on the growth characters of soybean was found better in comparison with normal flat bed sowing. Lone *et al.* (2010) also recorded higher soybean plant height in higher seed rate treatments. The results of experiment indicate that for achieving maximum productivity from soybean crop even in heavy soils in Chhindwara district of Madhya Pradesh, the soybean crop should be sown by preparing the land with Mole drain plough followed by ridge and furrow sowing system.

Advantages

- Management of irrigation water is improved and more efficient.
- Better crop production is possible even in continuous heavy rainfalls because of better drainage
- Yield potential is enhanced through improved tillage practices in heavy clay soils.
- Allows better stand establishment and reduced lodging for soybean
- Makes it possible to perform inter bed mechanical weed control during early crop cycle.
- Uses low seed rate.

References

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