Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 1084-1086
Received: 29-08-2020
Accepted: 09-10-2020

SS Kinge
M.Sc., Department of Agronomy, VNMKV Parbhani, Maharashtra, India

GA Bhalerao
Associate Professor, Department of Agronomy, VNMKV Parbhani, Maharashtra, India

AJ Rathod
M.Sc., Department of Agronomy, VNMKV Parbhani, Maharashtra, India

PN More
M.Sc., Department of Agronomy, VNMKV Parbhani, Maharashtra, India

PP Shinde
M.Sc., Department of Agronomy, VNMKV Parbhani, Maharashtra, India

Corresponding Author:
SS Kinge
M.Sc., Department of Agronomy, VNMKV Parbhani, Maharashtra, India

Influence of land configuration and crop residue management practices on soil moisture and rain water use efficiency

SS Kinge, GA Bhalerao, AJ Rathod, PN More and PP Shinde

Abstract
A field experiment was conducted at Experiment farm of Agronomy Department, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif*-2019 to study the influence of land configuration and crop residue management practices on soil moisture and rain water use efficiency. The experiment was conducted in split plot design with fifteen treatment combinations replicated thrice. Where in main plot consist of three land configuration practices *viz*., Flat bed(L_1), Broad bed furrow(L_2), Ridges & furrow (L_3) and sub plot having five treatments of crop residue management practices *viz*., (CR_1) Crop Residue @ 1.25 T/ha + 5 kg ha^{-1} decomposing microorganism, (CR_2) Crop Residue @ 1.25 T /ha + 10 kg ha^{-1} decomposing microorganism, (CR_3) Crop Residue @ 2.5 T /ha + 5 kg ha^{-1} decomposing microorganism. (CR_4) Crop Residue @ 2.5 T /ha + 10 kg ha^{-1} decomposing microorganism and (CR_5) without crop residue. The study of experiment revealed that broad bed furrow and Crop Residue @ 2.5 T/ha + 10 kg ha^{-1} decomposing microorganism was recorded highest soil moisture and rain water use efficiency over the rest of treatments.

Keywords: land configuration, crop residue management, soil moisture and RWUE

Introduction
Soybean (*Glycine max* (L.) Merrill) is a leguminous crop originated in China and belongs to sub family papilionaceae with family leguminaceae. It is the most important oil seed crop in India, owing to its several domestic and industrial uses, besides its use in numerous food preparations and animal feed formulations. Soybean accounts for about 53 % of the world production share among the oilseed crops, and has therefore, occupied an important place in most farming systems in the Marathwada region of Maharashtra State, India. Soybean, though is a rainy season crop but is highly sensitive to excess moisture conditions. Therefore, fast removal of excess water/water logging is necessary to protect the crop from damage. Water logging is detrimental to root growth and nodulation both. The excess moisture or water logging conditions during monsoon season create unfavorable conditions for growth, such as reduced porosity which in turn reduces soil aeration, reduced root growth, hampered nodulation, reduced nutrient uptake affecting the physiology and biochemistry of a plant adversely which ultimately reflects on its productivity (Negi *et al.*, 2018) [6].

Land management system plays a major important role in minimizing soil erosion and improving water use efficiency of field crops. Easy and uniform germination as well as growth and development of plant are provided by manipulation of sowing method. Land configurations have a major influence on soil aeration, moisture availability and temperature of soil which in turn affect the yield and quality of crop. The broad bed furrow and ridge and furrow are newly developed methods of soybean cultivation in India. Therefore, need to standardised land configuration for the cultivation of soybean in India. Land configuration increases water use efficiency and also increases availability of nutrients to crops (Chiroma *et al*., 2008) [1]. Land configuration *viz*., ridge and furrow and bed systems have been known to dispose additional rain water (runoff) faster than flat beds as in former two methods, furrows act as drainage channel. Rain water falling on the ridges or on the beds goes down to furrows, which carries it out from the fields. Consequently, the root zone of the crop receives less water in ridges and furrow and bed systems compared to flat beds. Land configuration is the prime work for better growth and development of any crop. Land configuration decides the effectiveness of the crop management practices regarding application of nutrient, irrigation, weed management etc. Proper land configuration according to the climatic conditions of the region *viz*., heavy rainfall area or drought prone areas or area with salinity hazards acts as management practice to the crop (Deshmukh *et al*., 2016) [2].

Land configurations for sowing of soybean have been used to enhance in situ rain water conservation and minimize soil erosion and nutrient losses during water stressed period and sometime act as drainage channels during water logged conditions (Kamboj *et al*., 2008) [5]. Water logging can be managed or mitigated to some extent by adopting or altering some suitable package of practices. Among the technologies planting technique is the most important, as change in layout methods will be useful for emergence and establishment of soybean which contribute to overall crop performance. Ram and Kler (2007) [7] reported that the broad bed furrow provides favourable environment for growth and development of the soybean crop under rainfed conditions. Land configuration is a potential tool for soil and moisture conservation. Appropriate land configuration like broad bed and furrow, ridges and furrow system increase crop yield due to increase in infiltration of water into soil profile and it becomes available to crop during prolonged monsoon break and control water crises in agriculture by the way 'more crop per drop'. It also decreases bulk density and penetration resistance and remove excess water. The loss in yield can be avoided or reduced if good amount of water is stored in the soil during rainy days and utilized by the crop during moisture stress or dry spell. At the same time there should be provision for drainage of excess rain water. Studies on soil management for increasing crop production revealed that use of various modifications of land configurations such as broad bed furrow, ridges and furrow for soybean in vertisol were superior over flat bed and recommended in watershed development for moisture conservation as well as for safe removal of excess rain water (Raut *et al.*, 2000) [8]. Among different conservation measures, straw mulching on soil surface to reduce evaporation rate and discourage the weeds is another water conservation practice in India. The combination of land configuration and straw mulching conserve the soil moisture and improve water use efficiency and grain yield. Organic mulches applied to suppress weed, conserve soil moisture, moderate soil temperature and suppress plant diseases. Therefore, our work is designed to investigate the influence of land configuration and crop residue on soil moisture content and RWUE.

Materials and Methods

A field experiment was conducted at Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during *kharif* season, 2019. The soil of experimental field was medium deep black, clay in texture, medium in organic carbon, low in available nitrogen (195.50 kg ha^{-1}), phosphorus (12.90 kg ha^{-1}) and high in potash (470.70 kg ha^{-1}). The environmental condition prevailed during experimental period was favorable for normal growth and development of soybean crop. The field experiment set up in a split plot design with three replications consisting of fifteen treatment combinations. The land configuration practices in main plot consist of Flatbed (L_1), Broad bed furrow (L_2), Ridges & furrow (L_3) and in sub plot five treatments on crop residue management practices *viz*., Crop Residue @1.25T/ha+5 kg ha^{-1} decomposing microorganism (CR_1), Crop Residue@ 1.25 T/ha +10 kg ha^{-1} decomposing microorganism (CR_2), Crop Residue @ 2.5 T/ha + 5 kg ha^{-1} decomposing microorganism (CR_3), Crop Residue @ 2.5 T/ha + 10 kg ha^{-1} decomposing microorganism (CR_4) and without crop residue (CR_5) were included in the investigation. Sowing of soybean variety MAUS – 71 was done on 27th June, 2019 at spacing 45 cm X 5 cm using 75 kg seed ha^{-1} in various land configurations. In case of flatbed sowing was done with Tractor drawn ferity seed drill. The broad bed furrow planter was used for preparation of (broad bed furrow) and sowing. In case of ridges & furrows, the ridges & furrows were prepared and sowing was undertaken. Crop residue application and decomposing microorganism spraying as per treatment was done after 21 DAS of crop growth. For the determination of moisture percentage, soil samples were taken from a depth of 0-15 cm with the help of screw auger. Then soil moisture percentage was determined from these samples by gravimetric method. The values of soil moisture percentage were used for computing rain water use efficiency.

Result and Discussion

Soil moisture content

Soil moisture in top soil layers (0-15cm) was estimated heavy rainfall and during dry spells. The amount of moisture the soil retains under a given condition is closely related to porosity and size of voids as well as properties of the soil particles. The soil moisture is modified by using different land configuration trough particle to particle contact and porosity of soil. The root growth and its proliferation are directly related to water availability in soil profile. Thus, soil moisture can greatly impact nutrient transformation, its release from organic forms, its uptake by roots and subsequent translocation and utilization by plant. Therefore, it is important to quantify the changes in soil moisture content as influenced by various land configuration practices. It is well known that degree of land configuration management highly influences the soil moisture content, even though the soil having same physical properties.

Effect of land configuration on soil moisture

In land configuration treatment higher moisture content in per cent was observed with the broad bed furrow (L_2) than treatments ridges & furrow (L_3), andflat bed (L_1). This might be due maximum conservation of soil moisture with treatment broad bed furrow consisting broad bed furrow prove its superiority by keeping the rhizosphere with adequate amount water content. Similar results reported by Shelke *et al.* (1998) [9].

Effect of crop residue practiceson soil moisture

Among the crop residue practices higher moisture content in per cent was observed with the treatment (CR_4) application of Crop Residue @ 2.5 T/ha + 10 kg ha^{-1} decomposing microorganism than (CR_3) Crop Residue @ 2.5T/ha + 5 kg ha^{-1} decomposing microorganism,(CR_2) Crop Residue @ 1.25 T/ha + 10 kg ha^{-1} decomposing microorganism and (CR_1) Crop Residue @ 1.25 T/ha + 5 kg ha^{-1} decomposing microorganism.. Whereas, treatment (CR_5)recorded lowest values. This might be due to adequate application of crop residue with treatment crop residue @ 2.5 T/ha + 10 kg ha^{-1} decomposing microorganism conserve higher percentage of moisture than without crop residue practices. The results are in line with the results of Dubey *et al.*(1993) [3] and Gajera *et al.*, (1998) [4].

Rain water use efficiency (kg ha-mm^{-1})

Land configuration and crop residue practices had profound effect on RWUE as given in table 2.

Effect of land configuration on rain water use efficiency

Highest rain water use efficiency of 3.20 kg ha-mm^{-1} was observed with treatment Broad bed furrow (L_2) than ridges & furrow (L_3)(2.89 kg ha-mm^{-1}) and lowest rain water use efficiency of 2.43 kg ha-mm^{-1} was recorded with Flat bed

(L_1). It might be due to more availability of moisture in the root zone, and consequently luxurious consumption of water in this treatment.

Effect of crop residue management on rain water use efficiency

The treatment (CR_4) application of Crop Residue @ 2.5 T /ha + 10 kg ha^{-1} decomposing microorganism recorded higher RWUE (3.33 kg ha-mm^{-1}) than Crop Residue @ 2.5 T/ha + 5 kg ha^{-1} decomposing microorganism (CR_3) (3.18 kg ha-mm^{-1}), Crop Residue @ 1.25 T/ha + 10 kg ha^{-1} decomposing microorganism (CR_2) (2.74 kg ha-mm^{-1})and Crop Residue @ 1.25 T/ha + 5 kg ha^{-1}(CR_1) (2.69 kg ha-mm^{-1}) decomposing microorganism whereas the treatment (CR1)recorded lowest values (2.24 kg ha-mm^{-1}). This might be due to conservation more moisture in treatment (CR_4) application of Crop Residue @ 2.5 T/ha + 10 kg ha^{-1} decomposing microorganism than other treatments and which resulted in more water use efficiency.

Conclusion

Our result of experiment revealed that land configuration and crop residue application management can conserve more soil moisture for greater soybean growth and yield in vertisol soil. However, using broad bed furrow along with application of Crop residue @ 2.5 T/ha +10 kg ha^{-1} decomposing microorganism observed conserve more soil moisture and highest rain water use efficiency resulting better crop growth and yield.

Table 1: Mean soil moisture content (%) at 0-15 cm depth influenced by various land configuration and crop residue management treatments in Soybean

Treatment	Total moisture content (%)							
	At sowing	Day after sowing						At harvest
		15	30	45	60	75	90	
Land configuration								
L_1-Flat bed	16.47	20.21	18.01	27.43	19.21	24.32	27.32	24.98
L_2-Broad bed furrow	18.55	24.28	22.08	32.92	23.77	28.16	31.16	28.66
L_3-Ridges & furrow	17.48	23.90	21.70	31.10	22.63	27.44	30.44	27.70
Crop residue management								
CR_1 - Crop Residue @ 1.25 T/ha +5 kg ha^{-1} decomposing microorganism	17.47	22.60	18.60	29.06	20.50	24.69	27.69	25.74
CR_2 - Crop residue @ 1.25 T /ha + 10 kg ha^{-1} decomposing microorganism	17.70	22.32	19.32	29.36	20.73	24.90	27.90	25.93
CR_3 - Crop Residue @ 2. 5 T/ha +5 kg ha^{-1} decomposing microorganism	17.56	23.87	22.87	32.20	24.03	28.70	31.70	29.30
CR_4 - Crop residue @ 2.5 T /ha +10 kg ha^{-1} decomposing microorganism	17.54	22.84	23.84	33.22	24.88	30.29	33.29	30.27
CR_5 - Without crop residue	17.23	22.36	18.36	28.59	19.20	24.63	27.63	24.33
General mean	17.50	22.80	20.60	30.48	21.87	26.64	29.64	27.12

Table 2: Rain water use efficiency influenced by various land configuration and crop residue management treatments in Soybean

Treatment	RWUE (Kg ha-mm^{-1})
Land configuration	
L_1-Flat bed	2.43
L_2-Broad bed furrow	3.20
L_3-Ridges & furrow	2.89
Crop residue management	
CR_1 - Crop Residue @ 1.25 T/ha +5 kg ha^{-1} decomposing microorganism	2.69
CR_2 - Crop residue @ 1.25 T /ha + 10 kg ha^{-1} decomposing microorganism	2.74
CR_3 - Crop Residue @ 2. 5 T/ha +5 kg ha^{-1} decomposing microorganism	3.18
CR_4 - Crop residue @ 2.5 T /ha +10 kg ha^{-1} decomposing microorganism	3.33
CR_5 - Without crop residue	2.24
General mean	2.84

References

1. Chiroma AM, Alhassan AB, Khan B. Yield and water use efficiency of millet as affected by land configuration treatments. J Sustainable Agric 2008;32(2):321-333.
2. Deshmukh SP, Jayesh Vasase, Patel AM. A short review of land configuration to improve the plant growth, development and yield of cereals. Int. J Interdisciplinary Res Innovation 2016, (1-4).
3. Dubey MP, Mishra PC, Purohit JP. Influence of mulching on double cropping of early soybean (*Glycine max* L.) and linseed (*Linum usitatissium* L.) under rainfed conditions. Indian Journal Agronomy 1993;38(3):361-364.
4. Gajera MS, Ahlawat RPS, Ardeshna RB. Effect of irrigation schedule, tillage depth and mulch on growth and yield of winter pigeon pea (*Cajanus cajan* L.). Indian Journal Agronomy 1998;43(4):689-693.
5. Kamboj BR, Malik RK, Garg R, Yadav A, Singh S, Goyal NK *et al*. Bed planting-a novel technique to encourage multiple land use. Technical Bulletin (29). Directorate of Extension Education, CCS Haryana Agricultural University, Hisar, India 2008, 24.
6. Negi A, Chilwal A, Bora R. Effect of Soybean Varieties under Different Land Configurations on Soil Moisture Status. Int. J Curr. Microbiol. App. Sci 2018;7(11):2130-2134.
7. Ram H, Kler DS. Growth analysis of soybean [*Glycine max* (L.) Merrill] and wheat (*Triticum aestivum* L.) in sequence under no tillage and permanent raised bed planting. Indian Journal of Ecology 2007;34:154-57.
8. Raut VM, Taware SP, Halvankar GB, Varghese P. Comparison of differentsowing methods in soybean. Journal of Maharashtra Agricultural Universities 2000;25(2):218-219.
9. Shelke DK, Oza SR, Narkhade WN, Bhole VM. On farm water management in vertisols opportunities and challenges. Seminar on sustainable crop production in vertisols organized by ISA, Parbhani Chapter during Feb. 7-8 at MAU Parbhani 1998;18:135.