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RESEARCH PAPER

Effect of mechanization with different land configuration on yield and *in situ* moisture conservation of soybean

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Abstract **:** An experiment was conducted during the *Kharif* season of 2009-10 to study the effect of mechanization with different land configuration on growth and growth attributes of soybean with RBD design. The treatment consisted of six land configuration treatments, *viz.,* T_1 (Flat bed layout), T_2 (BBF layout), T_3 (Ridges and furrow), T_4 (Flat bed + opening of furrow after every two rows at 30 DAS), T_5 (Flat bed + opening of furrow after every 5 rows at 30 DAS), T_6 (Conventional / farmer's practice) and replicated four times. Result showed that, yield contributing character *viz.,* number of pods plant^{-1}, seed yield weight (g) plant^{-1}, 100 seed weight (g), seed yield (q ha^{-1}), straw yield (q ha^{-1}) and harvest index (%) also found higher in broad bed furrow followed by ridges and furrow. Treatment of broad bed furrow with mechanized culture also improved significantly soil moisture content, consumptive use, relative water use and absolute water use.

Key Words **:** Soybean, Land configuration, Mechanization, Yield attributes, *In situ* moisture conservation

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INTRODUCTION

Soybean (*Glycine max.* L.) is one of the important oilseed as well as leguminous crop.It is the cheapest and richest source of high quality protein. It supplies most of the nutritional constituents essential for human health. Hence, soybean is called as wonder crop or golden bean or miracle bean. This crop in fact has made revolution in the agricultural economy with its immense potential, quality of food, feed, numerous industrial production commodity. Symbiotically soybean fixes 125-150 kg N ha^{-1} (Chandel *et al*., 1989)and leaves about 30-40 kg N ha^{-1} for succeeding crop (Sexena and Chandel, 1992).In India, soybean is grown over an area of 7.46 m ha with a production of 8.35 m tonnes and with average productivity of 1007 kg ha^{-1}. Madhya Pradesh, Uttar Pradesh and Maharashtra are the major soybean producing states (Anonymous, 2006).To improve yield potential and *in situ* moisture conservation of soybean, it is necessary to use mechanization with different land configurations. Patil (2005) stated that in soybean yield contributing characters like number of pods plant^{-1}, number of seed plant^{-1}, weight of pods plant^{-1} and weight of seed plant^{-1} were found significantly higher under ridges and furrow method of planting. Seed yield (1988 kg ha^{-1}), straw yield (4130 kg ha^{-1}) and biological yield (6135 kg ha^{-1}) were found significantly higher in ridges and furrow as compared to 1579 kg ha^{-1}, 2910 kg ha^{-1} and 4489 kg ha^{-1}, respectively on flat bed and Anonymous (2004) reported that land treatments are the practices that promote maximum conservation of rain water where it falls *i.e. in situ* moisture preservation and this can be achieved by adopting different land configuration treatments like ridges and furrows, broad bed furrows etc. Considering the above facts, attempt was made to study the effect of mechanization with different land configuration on yield and *in situ* moisture conservation of soybean.

MATERIALS AND METHODS

An experiment was carried out during *Kharif* 2009-10 at Gadadhi Block, Central Research station, Dr.Panjabrao

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Deshmukh Krishi Vidyapeeth, Akola (M.S.). The experiment was laid out in Randomized Block Design in four replications with six land configuration treatment *i.e.* T_1 (Flat bed layout), T_2 (BBF layout), T_3 (Ridges and furrows), T_4 (Flat bed + opening of furrow after every two rows, at 30 DAS), T_5 (Flat bed + opening of furrow after every 5 rows at 30 DAS), T_6 (Convention / Farmer's practice). In treatments T_1 to T_5 are mechanized culture with tractor. Gross plot size of 15 m x 4.5m with net plot size of 13.0m x 3.6m. The experimental site was clayey in texture, low in nitrogen content, medium in phosphorus and rich in potash, soil reaction was found to be slightly alkaline. Observations on yield and yield attributes *viz.,* number of pods plant^{-1}, seed yield weight (g) plant^{-1}, 100 seed weight (g), seed yield (q ha^{-1}), straw yield (q ha^{-1}) and harvest index (%).The moisture use studies *viz.,* Consumptive use, actual water use, relative water use were recorded.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of mechanization with different land configuration on yield and yield attributes:

Table 1 showed that all yield contributing characters were significantly influenced by different treatments of land configuration .Seed yield plant^{-1} (9.96 g), number of pods plant^{-1} (35.60) seed yield q ha^{-1} (19.59) and 100 seed weight (14.95 g) were recorded significantly higher in broad bed furrow T_2 over ridges and furrow T_3, opening of furrow after every two row T_4 and opening of furrow after every five row T_5.The treatment ridges and furrow T_3 also recorded significantly superior results of all these yield contributing character (8.84, 34.30, 18.20, 13.54) over rest of treatment opening of furrow after every two row T_4 (7.54, 33.20, 17.21, 12.48), opening of furrow after every five row T_5 (6.91,32.13,16.24,11.26), respectively, over farmers practice T_6 (2.94, 28.09, 12.15, 7.85). This increase in yield contributing character in broad bed furrow T_2 and ridges and furrow T_3 might be due to better drainage aeration and uptake of nutrients in these treatments plots.

These higher seed yield q ha^{-1} found in broad bed furrow T_2 was observed due to higher values for all yield contributing characters in T_2.This might be due to BBF avoids excess water or temporary water logging condition and provides relatively well drained and well aerated rooting medium on wet soil to which pulse crop are very sensitive and low yield in flat bed system farmers practice T_6 may observed because of water stagnation. Due to high intensity and frequency of rainfall affecting the growth and development of crop which ultimately results in low yield.

Straw yield and harvest index were influenced significantly by the different land configuration treatments. The higher values of harvest index was recorded in broad bed furrow T_2 (37.91%) followed by ridges and furrow T_3 (37.65%), opening of furrow after every two row T_4 (37.45%), opening of furrow after every five row T_5 (37.28%), flat bed T_1 (37%) and lowest value in farmers practice T_6 (36.55%). Similarly the highest value of straw yield was recorded in broad bed furrow T_2 (33.54 q ha^{-1}) followed by ridges and furrow T_3 (31.98 q ha^{-1}), opening of furrow after every two row T_4 (29.89 q ha^{-1}), opening of furrow after every five row T_5 (27.95 q ha-1), flat bed T_1 (23.15 q ha^{-1}) and lowest value of straw yield was obtained in farmers practice T_6 (19.40 q ha^{-1}).

These results are in the line with the results of Shinde *et al*. (2000).They revealed that in chickpea yield and yield attributes *viz.,* number of pods plant^{-1}, number of seed plant^{-1}, test weight, seed yield and straw yield were significantly influenced by ridges and furrow method of sowing. Significantly higher seed and straw yield (45.45 q ha^{-1}) and (80.35 q ha^{-1}) were obtained under ridges and furrow with 90 cm width as compared to 43.11 q ha^{-1} and 67.73 q ha^{-1},

Table 1 : Effect of mechanization with different land configuration on yield attributes

Treatments	No. pods / plant at harvest	Seed yield plant^{-1} at harvest	Seed yield q/ha at harvest	100 seed wt. (g) at harvest	Straw yield (q/ha)	Harvest index (%)
T_1 - Flat bed layout	29.81	4.30	14.04	9.36	23.15	37.00
T_2 – BBF layout	35.60	9.96	19.59	14.95	33.54	37.91
T_3 – Ridges and furrow layout	34.30	8.84	18.20	13.54	31.98	37.65
T_4 – Flat bed + opening of furrow after every two rows of 30 DAS	33.20	7.54	17.21	12.48	29.89	37.45
T_5 – Flat bed + opening of furrow after every five rows at 30 DAS	32.13	6.91	16.24	11.26	27.95	37.28
T_6 – Farmers practice	28.09	2.94	12.15	7.85	19.40	36.55
S.E. (m) ±	0.112	0.021	0.044	0.021	0.07	0.04
C.D. (P=0.05)	0.32	0.07	0.13	0.07	0.20	0.11
G.M.	32.19	6.75	16.23	11.57	27.65	37.31

respectively in flat bed method of sowing.

Effect of mechanization with different land configuration on *in situ* moisture conservation:

Soil moisture content was influenced significantly by different land configuration treatments at sowing and 20 DAS. At 20, 40, 60, 80 DAS and at harvest broad bed furrow T_2 treatment recorded significantly higher soil moisture content (28.05, 29.74, 31.69, 16.18 %, respectively) and was followed by ridges and furrow T_3 (26.30, 24.34, 28.33, 31.28, 15.69) .At 20 DAS broad bed furrow T_2 28.05 per cent was at par with the treatment ridges and furrow T_3 (26.30). Treatment opening of furrow after every two row T_4 (20.27) showed at par results with opening of furrow after every five row T_5 (20.38), flat bed T_1 (20.96) and farmers practice T_6 (20.57). At 40 DAS broad bed furrow T_2 (29.74) showed significantly higher results than ridges and furrow T_3 (24.34). Treatment opening of furrow after every two row T_4 (22.20) showed at par result with opening of furrow after every five row T_5 (22.43), flat bed T_1(22.16) and farmers practice T_6 (22.55).At 60 DAS T_3 recorded higher value of moisture content (28.33) but was at par with broad bed furrow T_2 (27.09). Treatment opening of furrow after every two row T_4 (22.35) was at par with opening of furrow after every five row T_5 (22.38) and flat bed T_1 (22.23) and found superior over farmers practice T_6 (21.91). At the time of harvesting broad bed furrow T_2 (16.18) recorded significantly higher value over rest of the treatments. Ridges and furrow T_3 (15.69) showed at par results with T_4 (15.61), T_5 (15.64) and flat bed T_1 (15.65). The lowest value of soil moisture was found in treatment farmers practice T_6 (14.57) (Table 2).

The results obtained from investigation revealed that the treatment T_1 to T_5 *i.e.* mechanized culture recorded significantly higher water content over treatment T_6 *i.e.* bullok drawn flat bed. Jayapoul *et al.* (1996) reported that yield of soybean, grown in *Kharif* and summer was highest in broad bed followed by ridges and control basin.

Seasonal consumptive use was found lowest in BBF (T_2) (300.4 mm) followed by ridges and furrows (T_3) (302.2 mm), treatment opening of furrow after two rows (T_4) (308.8 mm), opening of furrow after every five row (T_5) (309.2) showed near about similar result and superiority over flat bed treatment (T_1) (315.2 mm) and highest in treatment conventional practice (T_6) (320.4 mm) (Table 3).

Similarly relative water use (RWU) showing lowest (0.53) in BBF (T_2) followed by ridges and furrows (T_3) (0.53), treatment opening of furrow after two rows (T_4) (0.52), opening of furrow after every five row (T_5) (0.52) but were superior over flat bed (T_1) (0.51) and conventional practice (T_6) (0.50).

In case of absolute water use (AWU) mm day^{-1} similar result were found treatment BBF (T_2) showed lowest AWU rate mm day^{-1} *i.e.* (2.08 mm) followed by ridges and furrows (T_3) (2.18 mm), treatment opening of furrow after two rows (T_4) (2.89 mm) and opening of furrow after every five row (T_5) (2.89 mm) but showed superiority over treatment flat bed (T_1) (2.95 mm) and highest value of AWU was found in treatment T_6 (3.00 mm). These results are in the line with the results of

Table 2 : The soil moisture content (%) at 0-30cm depth as influenced by various treatments at different growth stages

Treatments	Sowing	20 DAS	40 DAS	60 DAS	80 DAS	Harvest
T_1 - Flat bed layout	22.03	20.96	22.16	22.23	25.49	15.65
T_2 – BBF layout	23.73	28.05	29.74	27.09	31.69	16.18
T_3 – Ridges and furrow layout	23.35	26.30	24.34	28.33	28.28	15.69
T_4 – Flat bed + opening of furrow after every two rows of 30 DAS	22.29	20.77	22.20	22.35	24.23	15.61
T_5 – Flat bed + opening of furrow after every five rows at 30 DAS	22.33	20.38	22.43	22.38	26.59	15.64
T_6 – Farmers practice	22.35	20.57	22.55	21.91	23.88	14.57
S.E. (m) $\pm$	0.15	0.31	0.10	0.60	0.19	0.13
C.D. (P=0.05)	0.44	0.93	0.30	1.80	0.58	0.39
G.M.	22.68	22.84	23.90	24.05	27.69	15.55

Table 3 : Consumptive use, relative water use rate, absolute water use rate (mm day^{-1}) and water use efficiency by the various treatments

Treatments	Consumptive use (mm)	Relative water use rate	Absolute water use rate (mmday^{-1})	Water use efficiency (kg ha^{-1} mm)
T_1 - Flat bed layout	315.2	0.51	2.95	4.45
T_2 – BBF layout	300.4	0.53	2.08	6.52
T_3 – Ridges and furrow layout	302.2	0.53	2.18	5.96
T_4 – Flat bed + opening of furrow after every two rows of 30 DAS	309.2	0.52	2.89	5.56
T_5 – Flat bed + opening of furrow after every five rows at 30 DAS	308.8	0.52	2.89	5.26
T_6 – Farmers practice	320.4	0.50	3.00	3.79

Pendke *et al.* (2004).They found that minimum runoff (114.0 mm) and soil loss (1.87 t ha^{-1}) were recorded under ridges and furrow with tied ridges as compared on flat bed (210 mm and 2.99 t ha^{-1}, respectively). Further they reported that in pigeonpea highest moisture use efficiency of 4.0 kg ha^{-1} mm was recorded in ridges and furrow with tied ridges over 2.57 kg ha^{-1} mm on flat bed method of planting.

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