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Performance of Soybean-Safflower Cropping System under BBF Land Configuration under Different Spacing and INM over Traditional Method

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A B S T R A C T

A field experiment was carried out during 2018-19 at AICRP on safflower, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The sowing of Soybean-safflower was carried out on broad bed furrow (BBF) to find out overall benefit over traditional method of sowing in *Rabi* season (winter) of 2018-19. In Kharif soybean crop sown on BBF fallowed by safflower in rabi on same bed with the help of BBF seed cum ferti seed drill. The average soil moisture in BBF method and traditional method was observed 30 % and 26%, respectively The sowing of safflower on BBF resulted in conservation of moisture in soil which was observed to be 11.95 % more as compared to traditional method of sowing. The conserved soil moisture has shown higher yield in BBF method. The observed higher yield of crop in BBF method 3 rows/BBF x 100% RDF + Azotobacter + PSB (1712 kg/ha) which was on par with 4 rows/BBF x100% RDF + Azotobacter + PSB (1569 kg/ha). Biological yield, safflower equivalent yield, gross returns, net returns and B:C ratio followed similar trend than traditional method of sowing.

Introduction

In rainfed farming, conservation of moisture in soil has great importance to improve the crop productivity. Watershed based conservation practices are not suitable every field it can possible in heavy rainfall or low land areas. For field crop need to adopt the in-situ based soil moisture conservation practices. The broad bed furrow based sowing of crop is an emerging practice in rainfed farming for not only increase in yield but also help for in-situ soil moisture conservation. It helps to conserve in-situ water and makes the moisture availability for the sown crops. There are different method of sowing crop for in-situ moisture conservation such as contour method of sowing conserves soil moisture but it affects traditional practices for carrying farm operations. Broad bed furrow method is a precision method for in-situ moisture conservation and it is technology which includes ploughing to improve effectiveness and efficiency of traditional drainage practices. Akbar (2007) found that there was about 36 % water saving for wide beds and

about 10 % for narrow beds and grain yield increase of about 6% for wheat crop and 33 % for maize crop. For dry land zone and to overcome water logging and improve soil structure on cropping soils in case of high rainfall zone BBF farming is become solution. The furrows act as pathways for drainage in excessive rain and conserve rainwater in dry spell (Astatke *et al.*, 2002). In rainfed agriculture oilseed crops play important role in economics and sources of fats and oils, which are essential for human diet, comprising about 40% of the calories in the diet of the average person. India is amongst the largest producer and consumer of vegetable oils in the World. Oilseeds have been the backbone of agricultural economy of India since long. Indian vegetable oil economy is the fourth largest in the world next to USA, China and Brazil.

Oilseed crops play the second important role in the Indian agricultural economy next to food grains in terms of area and production. Safflower [*Carthamus tinctorius*] is another very important oilseed crop grown world over. In India, it occupies about 5.9 m ha with a production of 6.8 m t with an average productivity of 1145 kg ha (Economic survey, 2012-2013). It is a major rabi oilseed crop in the country. Like soybean its productivity is also very low as compared to the global average. Safflower is also greatly affected by the poor nutrient management and soil moisture. The study was carried out to Performance of safflower under BBF land configuration under different spacing, INM over traditional method.

Materials and Methods

A BBF marker cum seed drill

It having mechanical seed metering device mainly consists of frame, seed and fertilizer box metering mechanism, ridgers for opening broad bed furrows, inverted T-type furrow openers and ground wheel or driving wheel. The overall length and width of this machine is 185 cm and 180 cm, respectively. The spacing between furrow openers can be increased or decreased according to the need of farmer or type of crop grown. The ridgers were provided to the implement for marking broad bed furrows. The broad bed furrows are prepared at the same time of sowing which save the time and cost of the operation. The furrow openers are inverted T-type and made of 10 mm thick mild steel. There are two boxes provided on seed drill, one for seed and other for fertilizer. To control the seed and fertilizer application rate, fluted type metering device was provided in the seed cum fertilizer drill. The seed adjustment lever was provided to control the seed rate. The power is transmitted to seed and fertilizer metering mechanism from ground wheel having 38 cm diameter by chain and sprocket arrangement. The depth of sowing can also be adjusted with the help of ground wheel

Sowing of soybean-safflower by using BBF

A field experiment was carried out during 2018-19 at AICRP on safflower, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. In Split factorial design with three replication and 12 treatment.

Treatment details

Main plot: BBF (2)

M1: Soybean (Short duration Variety)-Safflower (Zero tillage/relay sowing)
M2: Soybean (Normal duration Variety)-Safflower (Relay sowing)

Sub-plot: Safflower: Plant geometry

G1: 3 rows/BBF (row to row is 60 cm and plant is 15 cm)

G2: 4 rows /BBF (row to row is 40cm and plant to plant is 20cm)

IPNM: Soybean: RDF (30:60:30 P through SSP + seed treatment with Rhizobium) Safflower:

N1:No fertilizer
N2: 50% RDF (as DAP) + seed treatment with Azotobazter+ PSB
N3: RDF (as DAP) + seed treatment with Azotobacter+ PSB

Check plot: 10m x10 m

Sowing of Soybean by using BBF

For sowing of soybean by BBF method row to row spacing between crop rows on broad bed was kept 30 cm with five rows of soybean crop on BBF. Sowing soybean done in *kharif* 2018-19 on 12th June 2018. Two genotype used JS-9305- as short duration & MAUS-71 as normal duration. All recommended package of practice fallowed.

Sowing of safflower by using BBF

Safflower in BBF method, spacing between rows and the cropping pattern was changed over traditional method. Row to row spacing between crop rows on broad bed was kept 40 cm with 4 rows and 60 cm with 03 rows. The plant to plant spacing (20 cm) was kept same as in traditional method of sowing safflower crop. The average depth of placement of seed in BBF method was observed to be 5 cm sowing of safflower done on rabi 2018-19 on20th Sept.2018. (sowing pattern in BBF method Fig.1) and in traditional method sowing of safflower done with 45cm row to row distance and 20 cm plant to plant distance with depth of sowing 3 cm (sowing pattern in traditional method is shown in Fig. 2).

The data regarding moisture content of soil in both methods with the yield of crop was collected during the research work. The data regarding soil moisture content in the both methods was collected at month wise since from sowing to harvesting of safflower crop. System equivalent safflower based yield and economics was calculated.

Results and Discussion

Soil moisture

For determining moisture content of soil three samples of soil were selected randomly at three different depths, i.e. 0-5 cm, 5-10 cm and 10-20 cm from both the experimental plot. The average soil moisture for BBF method was found to be 34.86 % (db) and in traditional method was recorded to be 31.14 % (Table 1). Similar result observed by V. P. Khambalkar (2010). The mulching with rice-barn and organic manuring notably improved soil physio-chemical properties for supportive plant growth (Tekwa *et al.*, 2010). It was observed that in BBF sowing method (11.95 % more) soil moisture conserved over traditional method. Lenssen *et al.*, (2007) concluded that zero tillage had more available water at planting for safflower crop.

Yield, economics of Soybean-safflower cropping sequence

Yield of soybean

Soybean on BBF method of sowing recorded higher average yield i.e. (1437 kg/ha) over traditional method of sowing i.e. (1350 kg/ha).

Yield of safflower and Safflower equivalent yield, system economics

Application of nutrients has a vital role in early and vigorous plant growth especially under scarcity areas. Balanced application of fertilizers at the time of sowing led to higher plant growth. BBF with proper application

fertilizer and seed treatment might have conserved soil moisture and improve growth of plant it seems to increase in the yield of safflower might be ascribed to cumulative effect of improvement in the growth as well as yield attributes and increased availability of the essential nutrients throughout the crop growth period. The results of present investigation are in lines with that of Girase *et al.,* (1997. Yield of safflower observed higher in treatment 3 rows/BBF x 100% RDF + Azotobacter + PSB (1712 kg/ha) which was on par with 4 rows/BBF x100% RDF + Azotobacter + PSB (1569 kg/ha) over treatment 3 rows/BBF x no RDF & 3 rows/BBF x 50% RDF + *Azotobacter*+ PSB and 4 rows/BBF x no RDF & 4 rows/BBF x 50% RDF + *Azotobacter*+ PSB and check tradional method of sowing (1490 kg/ha). Similar trend observed in case of biological yield (Table 2 & 3). The moisture stress seriously affects on the grain amaranth than fertilizer stresses and yield of grain depends on the soil moisture status (Ejieji and Adeniran, 2010; Lenssen *et al.,* 2007). The better yield from crop grown on ridges compared with those on flat land (Tisdall and Hodgson, 1990). As found that average yields of soybean & safflower increased by 6% and 14% respectively over traditional method of sowing. The total productivity of the soybean-safflower cropping sequence expressed in terms of safflower equivalent yield indicated that it differed significantly due to BBF land configuration and nutrient management to both the crops during years of investigation. The safflower equivalent yield of the cropping system was significantly higher with the practice of broad bed furrows than the flat beds practices or traditional method of sowing. The higher equivalent yield (kg/ ha) might be attributed to proper utilization of nutrients due to its sustained availability which resulted in better crop growth and ultimately higher grain yield. Similar findings were also reported by Tomar *et al.,* (1996), Prajapat *et al.,* (2014) [25] and Wanil *et al.,* (2011). From the result of study it is found that performance of Soybean-safflower cropping system under BBF land configuration is better over traditional practice and sowing of safflower 3 rows/BBF x 100% RDF + Azotobacter + PSB fallowed by 4 rows/BBF x100% RDF + Azotobacter + PSB.

Table.1 Soil moisture in BBF and traditional method of safflower sowing season

Month	Soil moisture in BBF (%)	Soil moisture in Traditional (%)
October-19	50.5	45.2
November-19	41.22	40.15
December-19	35.75	31.11
Janevary-19	30.88	28.45
Februvary-19	30.2	25.33
March-19	28.75	24.5
April-19	26.75	23.25
Average soil misture (%)	34.86	31.14

Table.2 Soybean, safflower yield, safflower equivalent yield and system economics of BBF method sowing

Treatments	Seed yield (kg/ha)		Biological yield of safflower (kg/ha)	Safflower equivalent yield (kg/ha)	System economics			
	Soybean	Safflower			Gross Return (Rs/ha)	Cost of Cultivation (Rs/ha)	Net Return (Rs/ha)	B:C Ratio
Main plot (*Kharif*)								
Soybean - JS 9305 (Short duration)	1292	1745	8063	2337	93480	45350	48130	2.1
Soybean - MAUS-71 (Normal duration)	1581	1681	7530	2458	98320	45350	52970	2.2
S.Em±		44.7	71.3	22.1				
C.D (p≤0.05)		NS	434	NS				
Sub plot *(Rabi)* (Plant geometry x IPNM)								
3 rows/BBF x No Fertilizer		1013	4800	2016	80640	43900	36740	1.8
3 rows/BBF x 50% RDF + *Azotobacter*+ PSB		1268	6270	2303	92120	45400	46720	2.0
3 rows/BBF x 100% RDF + *Azotobacter* + PSB		1630	7510	2742	109680	46900	62780	2.3
4 rows/BBF x No Fertilizer		1109	5413	2108	84320	43800	40520	1.9
4 rows at/BBF x 50% RDF + *Azotobacter*+ PSB		1299	5677	2362	94480	45300	49180	2.1
4 rows/BBF x 100% RDF + *Azotobacter/* + PSB		1713	7797	2854	114160	46800	67360	2.4
S.Em±		54.2	342	64.5				
C.D (p≤0.05)		160	1010	190				
C.V (%)		9	13	7				
Interaction		NS	NS	NS				

Table.3 Soybean, safflower yield on traditional method of sowing

Check plot 10x10m2	seed yield (kg/ha)	GMR Rs/ha	NMR Rs/ha	cost of cultivation (Rs./ha)	B:C ratio
Soybean(ND)	1350	39825	19125	20700	1.92
Safflower	1490	59600	33450	26150	2.28

Fig.1 BBF method

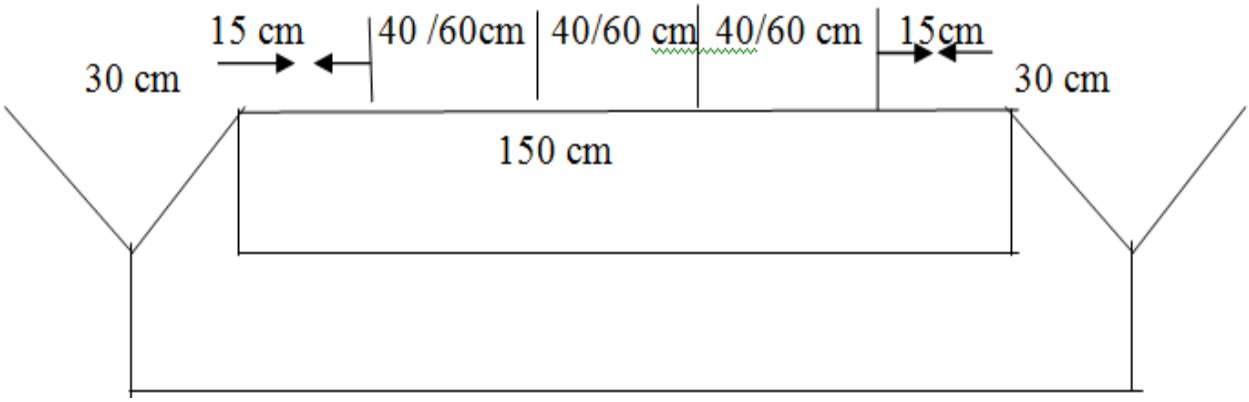
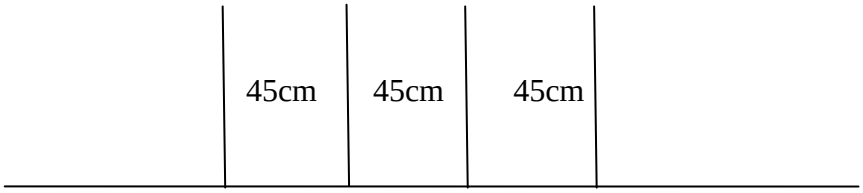


Fig.2 Traditional method



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