



Research Article

ASSESSMENT OF SESAME BASED INTERCROPPING SYSTEM UNDER RAINFED SITUATION

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Abstract: The On Farm Trial was conducted at Bharehara village of Adhaura block in Kaimur district of Bihar for sesame based intercropping system to assess Yield Equivalent Ratio (YER), Land Equivalent Ratio (LER), income and BC ratio as well as also to achieve more net return and more land productivity over existing cultivation of sesame as sole crop for rainfed condition. Two technology options – sesame + pigeonpea (2:1) and sesame + blackgram (2:2) were assessed over existing farmers' practices that was sesame as sole crop. No. of replications (no.of farmers) were eight and we found that Yield Equivalent Ratio (YER) was found highest yield 6.34q/ha by intercropping of sesame with blackgram (2:2) in technology option - 2 followed by technology option - 1 (sesame with pigeonpea 2:1) which gave sesame equivalent yield 5.15q/ha. Lowest yield was achieved by farmers' practice 4.20q/ha from sesame as sole crop. Net return and Benefit Cost Ratio were also found maximum in tech. option -2 followed by tech option -1.

Keywords: Sesame, Pigeonpea, Blackgram, Yield, Yield Equivalent Ratio (YER), Land Equivalent Ratio (LER) and Significance Test

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Introduction

Photo-periodically sesame is a short duration crop, fit well in to various cropping systems as well as mostly belongs to those farmers who are marginal and small with poor resources. (Annual Report, 2013-14, AICRP, Sesame and Niger, Jabalpur). The sesame has excellent, nutritional, medicinal and industrial values; hence it is called the 'queen of oilseeds'. The seed possesses 50 percent oil, 25 per cent protein and 15 per cent carbohydrates. It is a globally important oilseed crop and is adapted to tropical and subtropical regions in diverse ecosystems including rainfed (>300 mm rainfall), dry land (<300 mm rainfall), irrigated and coastal. Globally, it is cultivated across 75 countries in an area of 9.98 million hectare with a production of 5.53 million tones(FAOSTAT, 2017). India ranks first in area (19.01Lakh ha) under sesame with 8.6 Lakh tones production and earns Rs. 2880 crores through export. In India, it is grown in all season and it occupies 4th position among oilseed crops and the crop is mainly cultivated in 11 states including Madhya Pradesh, Uttar Pradesh, West Bengal, Rajasthan, Gujarat, Tamil Nadu,

Karnataka, Andhra Pradesh, Telangana, Maharashtra and Orisha with varied productivity levels ranging from 224 to 933kg/ha. In Bihar, area, production and productivity of sesame was 2437ha, 889.51mt and 3.65q/ha respectively (Directorate of Economics and Statistics, Govt. of Bihar, pooled data of three years-2015-16 to 2017-18). Out of 38 district of Bihar, Kaimur district contributed 97ha area, 20.66qtl production with 2.13q/ha productivity but productivity was lower than state yield. Mainly sesame production came from plateau and semi plateau area (Plateau-Adhaura block and semi plateau-Bhagwanpur, Rampur, Chainpur and Chand blocks) under rainfed condition due to more upland area and much availability of phosphorus in the soil to support root development. KVK Kaimur implemented many demonstrations on sesame in rainfed area of Adhaura block with the support of latest improved varieties and other inputs to increase the area, production and productivity under CFLDs (Cluster Front Line Demonstrations since the year 2015 and FLDs (Front Line Demonstrations) before the year 2015 and we found that yield was increased between 50percent and 100 percent over local practices.

After CFLDs mostly farmers did not adopt whole package of practices due to poor resources and thus low net return was being received by them caused non feasibility. Mixed cropping of maize with pigeonpea/jowar/bajra and pigeonpea with blackgram/maize was already adopted by farmers since a long years in plateau region under rainfed condition to reduce risk towards production and income but land productivity could not achieved up to mark. A few research papers were studied by us and we found that intercropping was proven beneficial for farmers with respect to better net income, more than one land equivalent ratio as well as higher yield equivalent ratio than sole crops [1-4]. Biradar, *et al.*, (2020) [5] found that pigeonpea + foxtail millet(1:2) was recorded more remunerative over sole cropping for rainfed condition. Lingaraju, *et al.*, (2008) also found that intercropping of maize + pigeonpea at 4:2 row ratio with 100:50 population recorded significantly higher maize yield(8970kg/ha), net return Rs.36008 and BC ratio 3.25 over sole cropping system maize. Mandal and Chhetri (2019) [6] also supported and told that sesame + blackgram(2:4) intercropping supplied with irrigation twice was best for obtaining overall gain. KVK felt and decided to conduct an On Farm Trial (OFT) on sesame based intercropping system to achieve more net return and more land productivity over existing cultivation of sesame as sole crop for rainfed condition.

Materials and Methods

We selected Barehara village of Adhaura block at Kaimur district in Bihar purposively because of more coverage of sesame in upland in kharif season under rainfed situation. Second step, we organized a meeting of sesame growers and prepared a list of those farmers who were engaged their massive area under sesame cultivation. They were asked about yield and income from sesame and they told us that yield was varied from 4.00q/ha to 4.30q/ha and income was ranged from ₹ 28000 to ₹ 30500/ha due to demonstrative effect. In the third step, we told them about our objectives regarding intercropping of sesame with pigeonpea (2:1) and sesame with blackgram (2:2) with control sesame as sole crop to increase net return and benefit- cost ratio from the same unit area.

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Table-1 Performance of the Technology with performance indicators (mean data), no. of replication = 8

Technology Option	Yield Equivalent Ratio (YER) Q/ha	LER (Land Equivalent Ratio)	Cost of cultivation(Rs./ha)	Gross Return (Rs./ha)	Net Return (Rs./ha)	BC ratio
Farmers' Practice (Sesame as sole crop)	4.2	1	15200	29400	14200	1.93
Tech. Option-01 (Sesame+Pigeonpea(2:1))	5.15	1.05	16950	36050	19100	2.12
Tech.Option-02 (Sesame+Black gram(2:2))	6.34	1.25	17700	44400	26700	2.5
SEM ±	0.066	0.019	17700			
CD (5%)	0.201	0.057				
CV (%)	3.577	4.802				

Sesame(2.15)+Pigeon pea(5.25)**Sesame(2.40)+Blackgram(4.60), Sale Price: Sesame@Rs.70/kg, Pigeon pea @Rs.40/kg and Blackgram@Rs.60/kg.
Means are found significant at 55 and 1% level also in YER and LER.

Finally, 8 (eight) sesame growers were selected who were highly interested to participate for conducting 'On Farm Trial' on their farms and to cooperate KVK scientists to collect information from sowing to harvesting as well as to estimate cost, yield and income. Thus 24 plots (each plot size 0.10ha) of eight farmers (8 replications) with two technology options-sesame + pigeonpea and sesame + blackgram along with farmers' practice-sesame as sole crop were taken under study to assess the performance of above said technology with performance indicators like YER, LER, cost and return etc. OFT was conducted in the year 2018-19 in kharif season and assessment was done in 2018-19 and 2019-20 due to harvesting of pigeonpea in the month of April 2019-20. YER and LER were calculated by using following formula:

YER = Yield of sesame + [Yield of pigeonpea or blackgram (qtl/ha) x Price of pigeonpea or blackgram(Rs./qtl)] / Price of sesame(Rs./qtl)

LER = (Yield of sesame in intercropping / Yield of sole sesame) + (Yield of pigeonpea or blackgram in intercropping / Yield of sole pigeonpea or sole blackgram)

Results and Discussion

On the basis of eight replications, that Yield Equivalent Ratio (YER) was found highest yield 6.34q/ha by intercropping of sesame with blackgram (2:2) in technology option-2 followed by technology option-1 (sesame with pigeonpea 2:1) which gave sesame equivalent yield 5.15q/ha [Table-1]. Lowest yield was achieved by farmers' practice 4.20q/ha from sesame as sole crop. [Table-1] indicated that intercropping of sesame with pigeonpea and blackgram at 2:1 and 2:2 rows ratio was recorded significantly higher sesame yield than sole cropping system sesame. LER (1.25) in technology option-2 (sesame with blackgram (2:2)) was found significantly superior to tech. option-1 and farmers' practices. There was no difference between the LER (Land Equivalent Ratio) of Tech option-1 and farmers' practice. Gross return of Rs.44400, Net return Rs.26700 and BC ratio 2.50 was found maximum in tech option-2 followed by tech. option -1 (gross return, net return and bc ratio was Rs.36050, Rs.19100 and 2.12 respectively) where as gross return, net return and bc ratio was found Rs.29400, Rs.14200 and 1.93 respectively in farmers' practices as indicated in [Table-1].

Conclusion

Best suitable technology was found technology option-2 (sesame + blackgram 2:2 ratio) with respect to LER, YER, net return, bc ratio and significantly higher than tech option 1 and farmers' practice for rainfed situation. Technology option -1 was also found better than farmers practice regarding YER but not to LER. Generally yield equivalent ratio depends up on prevailed market rate and yield of selected crops in intercropping. Weed infestation was the main constraint during trial. Feedback for researchers were found that farmers were using broadcasting method of sowing of oilseed and pulses due to lack of line sowing machine like seed drill and zero till. Determinate varieties should be developed of sesame, pigeonpea and blackgram so that mostly siliqua and pods would be ripened with one time to save labour cost for harvesting. Finally, farmers participated in cultural practices and they were ready to adopt intercropping.

Application of research: Study of Sesame based intercropping system

Research Category: Intercropping System

Abbreviations: YER-Yield Equivalent Ratio, LER-Land Equivalent Ratio

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Study area / Sample Collection: Krishi Vigyan Kendra, Kaimur, 821116, Bihar, India

Cultivar / Variety / Breed name: Sesame, Pigeonpea, Blackgram

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Ethical Committee Approval Number: Nil

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