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OFAR (on farm adaptive research) establishes appropriate sowing time and options to escape yellow mossaic virus attack in rainfed blackgram in Sagar (Madhya Pradesh)

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ABSTRACT : An OFAR (On-Farm Adaptive Research) experiment was conducted by farmers during the *Kharif* season of 2013 through in 10 villages of Shahgarh *Tehsil* and block in Sagar district of Madhya Pradesh under the SAF-BIN programme, to study the rsponse of different sowing date of rainfed blackgram in the context of climate change**.** Randomized block design with four replications were followed in the experiment. Crop was sown in 3rd week of June, 4th week of June and 1st week of July. Data were collected at 15 days interval for growth attributes (number of branches/plant, number of nodules/plant, dry weight as g/ plant) days to maturity, yield attributes and yield (number of pods/plant, seed yield kg/ha and harvest index %). The highest yield (680 kg/ha) and yield attributes was obtained in variety Shikhar3 sown in 3rd week of June. Further, a decline of 8.8%was observed in 4th (next week) week of June(625 kg/ha). Due to failure of replications under the treatments T5 and T6, only two replications were considered for the analysis. The result of this study in the smallholder farmer fields illustrates the importance of sowing date for maximizing the yield potential of rainfed blackgram (urdbean). The 3rd week of June was found to be suitable for rainfed condition of Sagar, Madhya Pradesh.

Key Words: Rainfed blackgram, sowing date, growth attributes, yield components, grain yield, varieties, smallholder farmers', on-farm adaptive research (OFAR).

Blackgram has been distributed mainly in tropical to sub-tropical countries. India is its primary origin and is mainly cultivated in Asian countries including Pakistan, Myanmar and parts of southern Asia. About 70% of world's blackgram production comes from India. India is the largest producer as well as consumer of blackgram. It produces about 1.09 million tons of uradbean annually from about 3.5 million hectares of area, with an average productivity of 500 kg per hectare. Blackgram output accounts for about 10% of India's total pulse production (GOI, 2013). In Madhya Pradesh, blackgram is grown in an area of 6,40,900 hectares with an annual production of 2,64,800 tonnes and productivity is 413 kg/ha (2012-13). In Sagar district, blackgram is grown in an area of 29,200 hectares with an annual production of 13,300tonnes and productivity 455 kg/ha (GOMP, 2013).

India is a major pulse growing country in the world which shares 30-35 % and 27-28% of the total area and production of pulses, respectively. The increase in pulses production has been only marginal and may be microscopic when compared with the phenomenal increase achieved in wheat and rice. Pulses are important constituent of Indian diet and supply meager part of protein, essential amino acid and enrich the soil through symbiotic N fixation from atmosphere. It maintains the normal growth, development and health of mankind, as these are acting as fertilizer devices their value is increased. To fulfill our future requirement, it is must to follow the scientific production of pulses. Amongst all the factors of crop production, timely planting is important in all crops and in all seasons. Blackgram and green gram crops are grown in spring summer and rainy season. Blackgram is perfect combination of all nutrients, which includes proteins (25-26%), carbohydrates (60%), fat (1.5%), minerals, amino acids and vitamins. It stands next to soybean in its dietary protein content. It is rich in vitamin A, B1, B3 and has small amount of thiamin, riboflavin, niacin and vitamin C in it. It contains 78% to 80% nitrogen in the form of albumin and globulin. The dry seeds are good source of phosphorus. It also has very high calorie content. Every 100 gm of blackgram has 347 calories.

Despite of these features, the productivity of crop is below the average owing to several soil related constraints such as low organic matter and poor soil fertility. Hence, it requires sincere efforts to enhance its productivity. In MP blackgram is commonly sown in rainy season in the months of June and July depending on the rains (according to farmers of MP). It is therefore, important to ascertain the exact sowing time of blackgram crop- with availability of rains in MP (Panotra *et al.*, 2016).

By keeping this factor in view an OFAR experiment entitled "Varietal performance of blackgram (*Vigna mungo* L. Hepper) on different dates of sowing" was carried out in *Kharif* 2013 at the Sagar district of MP with the objective to find out the optimum date of sowing for blackgram in Sagar locality.

The climatic parameters like rainfall and temperature are the major determinants of pulses productivity

besides other factors like associated biotic stresses (Dubey *et al.,* 2011; Ali and Gupta, 2012). These parameters indirectly depend on sowing dates.

Chaudhary *et al.* (1989) reported that delay in sowing on successive dates decreased yields and 100-seeds weight. Mittal (1999) considering both the reduced disease incidence and increased yield, the second fortnight in June is proposed as the optimum time for sowing blackgram.

Therefore, there must be a specific genotype during the relevant season for different sowing period to obtain maximum yield as opined by Kalra *et al*. (2008) for spring season.

Materials and Methods

The OFAR (On Farm Adaptive Research) experiment was conducted during the *Kharif*season of 2013 under SAF-BIN Programme, co-financed by Caritas India and European Union in 10 villages of Shahgarh *Tehsi l*and block in Sagar district of Madhya Pradesh in central India in of the Vindhya Range. It is around 180 km Northeast of state capital, Bhopal and at an altitude of 1758 ft. above mean sea level between North latitude 23°10" to 24° 27" and East longitude 78°4" to 79°21". Smallholder farmers participated in the research experiment conducted in their farms.

To study the response of rainfed blackgram to varieties under OFAR in the context of climate change in Sagar (Madhya Pradesh). The experimental design was a randomized block design with four replication. However, treatment T5 and T6 were replicated only twice. The experiment was conducted during *Kharif* season 2013 with cultivars Shikhar 3 and *Khajua* in combination with three sowing dates, *viz.*, 3rd week of June, 4th week of June, 1st week of July. The common practices were, *viz.*, DAP 125 kg/ha (basal application), seed treated with Carbendazim @ 2 g/kg seed, PSB @ 25g/ kg seed and Neem oil 0.33% spray used for the control of YVMV (Yellow Vein Mosaic Virus) between 35-45 DAS. All the cultural practices were carried out manually by smallholder farmers' in their respective experimental plots. The rainfed crop of blackgram was sown by traditional method of broadcasting.

Results and Discussion

Growth attributes

At 60 DAS the highest plant height 49.81cm was recorded under T_1 (sowing in 3rd week of June + Shikhar3), which was 19.64% higher than the lowest value 41.63 cm in T_4 (sowing in 4th week of June + *Khajua*). In case of July sowing also recorded the lowest value 36.30 cm in same variety. The probable reasons for increasing height may be due to different sowing dates. Increasing plant height under early sowing may be attributed to availability of relatively more time by the plants and high rainfall during growing season. Plant height was generally reduced in delayed sowing in case of blackgram. Similar finding was reported by Ramzan *et al*. (1992).

With regard to nodules the highest value of 77.56 nodules/plant was observed in T_2 (*Khajua* sown during 3rd week of June).Which was 16.19% higher than lowest value 66.75 in July sowing in the same variety. The increased number of nodules may be due to greater root development and nodulation of plant in long time during early sowing (Kumawat *et al*., 2008&2009).

The dry matter production was highest 8.78 g/plant observed in T_1 (Shikhar 3 sown during 3rd week of June) at 60 DAS, which was 55.39% higher than in the treatment T_4 (*Khajua* sown during 4th week of June). Probable reason for increasing dry matter accumulation of plant may be due to level of phosphorus and date of sowing. Singh *et al*. (2006) reported that increasing level of phosphorus increased dry matter accumulation of plant. Phosphorus application might have resulted in root proliferation and increased density of root nodules, which in turn resulted in higher microbial activities in the root and hence better availability of N and P to plant occurred. This increased uptake of nutrient manifested in increased growth. According to Rabbani *et al.* (2013) plant dry weight were affected by date of sowing.

Shikhar 3 possesed increased plant growth characteristic as compared to *Khajua*. Enhanced growth may be attributed to increase in dry matter production (Gupta *et al*., 2005). Cultivar Shikhar 3 was resistant to yellow vein mosaic virus and pod borer. Further, cultivar Shikhar 3 was also observed to be tolerant to environmental stress (water logging condition) as compared to the soybean crop.

Yield and yield attributes

Sowing dates is an important management tool to maximize yield potential of blackgram.

The observation (Table-1) showed that there was significant difference of treatments on seed yield (kg/ ha). However, in T_3 (Shikhar 3 sown during 4th week of June) was statistically at par to that obtained under T_1 (Shikhar 3 sown during 3rd week of June).Seed yield of summer blackgram was significantly influenced by sowing date. Similar finding reported by Miah *et al*. (2009).

Further, with regard to yield attributes and stover, seed yield the highest value, *viz*., 29.00 pods/plant, 2412.50 kg/ha, 680.00 kg/ha were registered in the treatment T_1 (Shikhar 3 sown during 3rd week of June). The results also supported by Mittal (1999) as an opti-

Table-1 : Sowing dates effect on growth and yield of blackgram under rainfed farming.

	Treatments	Growth attributes at 60 DAS		Yield attributes and yield		
		Plant height (cm)	No. of nodules/plant	No. of pods/plant	Stover yield (kg/ha)	Seed yield (kg/ha)
T_1	Shikhar 3 sown during 3rd week of June	49.81	64.75	29.00	2412.50	680.00
T_2	*Khajua*sown during 3rd week of June	45.11	77.56	15.25	1721.25	251.25
T_3	Shikhar 3 sown during 4th week of June	43.72	71.06	24.12	2060.00	625.00
T_4	*Khajua* sown during 4th week of June	41.63	69.87	15.37	1966.25	338.75
	S Ed (±)	6.98	6.73	6.59	461.22	125.40
	CD (P=0.05)	NS	NS	NS	NS	276.00
	CV (%)	16.14	9.66	32.76	24.25	26.22
T_{5*}	Shikhar 3 sown during 1st week of July	36.30	62.87	21.25	1540.00	617.50
T_{6*}	*Khajua* sown during 1st week of July	35.42	66.75	12.37	1155.00	375.00
	S Ed (±)	9.87	9.52	9.32	625.26	177.35
	CD (P=0.05)	NS	NS	NS	NS	NS
	CV (%)	22.83	13.67	46.34	34.30	37.08

*Replicated twice

mum sowing date for maximum yield of blackgram. Soomro (2003) reported that delay in sowing causes a substantial decrease in all the growth and development parameters of mungbean these results contradictory to this research findings also.

The yield parameters of variety Shikhar 3 also depicts that the crop performed better under heavy rainfall (1349.25 mm received from 67 rainy days) condition.

The highest seed yield/ha may be due to early sown crop (Yadahalli and Palled, 2004) and more uptake of P (Singh and Singh, 2000) as expressed due to variety (Ihsanullah *et al.,* 2002).

The result of this study illustrates the importance of time of sowing for maximizing the growth and exploiting higher yield potential of rainfed blackgram sowing date, 3rd week of June was found to be suitable for rainfed condition in Sagar.

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