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Evaluation of Yield Attributes and Yield on Pearl Millet (*Pennisetum glaucum*) and Mungbean (*Vigna radiata* L.) Intercropping System under Arid Western Plain Zone of India

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ABSTRACT

A field experiment was conducted during kharif, 2015 to evaluate yield attributes and yield on pearl millet + mungbean intercropping systems in arid region of Rajasthan. The experiment comprises twelve treatments viz., Sole HHB-67, Sole RHB-177, Sole RMG-62, Sole SML-668, HHB-67+RMG-62(1:1), HHB-67+RMG-62(1:2), HHB-67+SML-668(1:1), HHB-67+SML-668(1:2), RHB-177+RMG-62(1:1), RHB-177+RMG-62(1:2), RHB-177+SML-668(1:1), RHB-177+SML-668(1:2) were laid out in randomized block design with four replications. The results showed that number of effective tillers earhead lenghth of pearl millet at harvest were recorded significantly higher in RHB-177+SML-668(1:2) row ratio. There was no significant effect of different treatments on test weight of pearl millet and mungbean. Significantly higher grain yield and harvest index of pearl millet were recorded in sole RHB-177 while in intercropping treatments RHB-177+SML-668 in row ratio 1:1 recorded higher grain yield, however, stover and biological yield were recorded highest in RHB-177+RMG-62 in row ratio 1:1. Sole mungbean SML-668 among all treatments recorded significantly higher, no. of pods plant^{-1}, seeds pod^{-1} grain, straw and biological yield while in intercropping, treatments RHB-177+SML-668 in row ratio 1:2 recorded higher seed yield and harvest index of mungbean, however, straw and biological yield were recorded in HHB-67+SML-668 in row ratio 1:2.

Key words: *Pearl millet, Mungbean, Intercropping, Yield*

INTRODUCTION

Pearl millet [*Pennisetum glaucum* (L.).Br Emend stuntz.] Popularly known as Bajra have rank sixth in important cereals followed by wheat, rice, corn, barley and sorghum in the world. However in India, it is fourth most important cereal crop in area after rice, wheat and sorghum. It has the greatest potential among all the millets. India is the largest producer of pearl millet with an annual production of 9.05 million tonnes from an area of 7.12 million ha with productivity of 1272 kg ha^{-1}.

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Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana are the major pearl millet growing states In India, together they contribute approximately 95 per cent of total area and production in India. Rajasthan ranks first in both area (4.1million ha.) and production (4.5 million tones) and contributes about 50% area and 42% of production of pearl millet in the country. Average productivity of pearl millet in Rajasthan is 1097 kg ha^{-1}. In Rajasthan, pearl millet cultivation is mainly confined to the arid (62% of total area) and semi-arid (12.60% of total area) regions.

Mungbean [*Vigna radiata* (L.) Wilczek.] is one of the major pulse crop which is also known as moong, Greengram and golden gram is mostly cultivated in arid and semi-arid region. In India, Mung bean is the third important pulse crop after chickpea and pigeonpea. The major growing states are Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Maharashtra, Rajasthan, Bihar, Gujarat and Orissa. In india area, production and productivity of mungbean is 3.05 million ha, 1.51milliontones and 494 Kg ha^{-1} respectively. In Rajasthan it is mainly cultivated in Nagaur, Jaipur, Jodhpur, Sikar, Pali, Jhunjhunu and Ajmer districtsand occupied 0.9 million ha area and production 0.47 million tones with productivity 518 Kg ha^{-1}. (*www.mospi.nic.in*, *2014-15*).

Among the major crops compatible with pearl millet as intercrop, mungbean [*Vigna radiata* (L.) wilczek] is one of them. It is an annual legume of dry and warm habitat and characterized as one of the most drought hardy annual legume in arid region. Mungbean with deep fast penetrating root system in commitment with drought avoidance capabilities can survive and thrive up to long period in open field exhibiting fast depletion of soil moisture coupled with very high atmospheric temperature. The multi adaptive and adjusting the nature of this crop has enabled it to become a crucial part of all type of cropping and farming system of the arid region. With the increased availability of new cultivars of pearl millet and mungbean differing widely in plant type and maturity periods considerable scope exists to develop more productive pearl millet + mungbean cropping system to increase and stabilize the yield of both crops in arid region.

MATERIALS AND METHOD

A field experiment on intercropping system of pearl millet and mungbean varieties was conducted during Kharif season, 2015 at Agronomy Farm, College of Agriculture, Bikaner, Rajasthan. The soil was loamy sand with pH 8.5, available N 88.50 kg ha^{-1}, P 22.12 kg ha^{-1} and K 231.4 kg ha^{-1}. The twelve treatments viz., Sole HHB-67, Sole RHB-177, Sole RMG-62, Sole SML-668, HHB-67+RMG-62(1:1), HHB-67+RMG-62(1:2), HHB-67+SML-668(1:1), HHB-67+SML-668(1:2), RHB-177+RMG-62(1:1), RHB-177+RMG-62(1:2), RHB-177+SML-668(1:1), RHB-177+SML-668(1:2) were laid out in randomized block design with four replications. In intercropping treatments row to row distance was maintained 30 cm and sowing was done on 18 July, 2015 by "Pora" method using seed rate of 4 kg ha^{-1} and 20 kg ha^{-1} for pearl millet and mungbean respectively. 30 kg ha^{-1} each of nitrogen and phosphorus was applied as uniform basal dose at the time of sowing and 30 kg N ha^{-1} was top dressed in the pearl millet rows only at 25 days after sowing (DAS). The harvesting of pearl millet cultivars HHB-67 and RHB-177 was done on 10 october 2015 respectively while harvesting of mungbean RMG-62 and SML-668 was done on 1st October and 6th, 2015

respectively. Crop received 314.4 mm of rainfall in 14 rainy days.

RESULTS AND DISCUSSION

Table 1. shows that Intercropping systems RHB-177+SML-668(1:2) row ratio produced higher number of effective tiller plant^{-1} of pearl millet. It might be due to lower density of pearl millet and wider space available for more growth and development of pearl millet as compared to all other row ratios. Bengali[1] and Tiwari et al.[7], reported similar results. Better environment particularly the light interception by outer rows of pearl millet in this row ratio lead to higher effective tillers plant^{-1} in these treatments or this might be due to development of better complementary relationship and non-renewable resources like water, nutrients and incoming sunlight. These results are in close conformity with the findings of Rathore and Gautam[5]. Significant effect on length of ear head was recorded in RHB-177 as compared to sole HHB-67. Whereas among intercropping treatments, more length of ear head was recorded RHB-177 was involved irrespective of the row ratios. This might be due to difference in genotypic characters of both the varieties. Tiwari et al.[7], reported similar results. Mungbean SML-668 is a long duration variety which had significantly higher number of pods plant^{-1} compared to short duration maturing variety RMG-62. These findings were supported by Yadav and Yadav[9] and Tiwari et al.[7]. The differences in number of branches per plant were reduced in both the row ratios of intercropping systems as compared to their sole cropping. which perhaps due to the fact that competition offered by pearl millet for natural resources, resulted in poor development of intercrops and also due to less space available for horizontal spread of plants and intraspecific competition for incoming sun radiation. Choudhary *et al*.[2], and Yadav et al.[8], found similar results.There was no significant effect on test weight of pearl millet and mungbean. Singh and Aggarwal[6] and Prajapat[4] also reported the similar results.

A significant reduction in seed, stover and biological yield of pearl millet and mungbean was observed under intercropping system. This reduction in yield of pearl millet and mungbean in the intercropping system was primarily due to reduction in plant stand as of both the component crops were in a replacement type of intercropping system and reduction in pods plant^{-1} of mungbean irrespective of the cultivars. However more reduction in pods plant^{-1} was observed in RMG-62 than SML-668. These results are supported with those of Kumar *et al.*[3], Tiwari *et al*[7]. It was also noticed in the intercropping that yield reduction in mungbean SML-668 was significantly lower than the cultivar RMG-62 irrespective of the row ratios and pearl millet varieties, however more reduction was noticed in mungbean in intercropping with RHB-177 was taken as RHB-177 of pearl millet is long duration variety which compete with the component crop SML-668 row ratio 1:1 which is the long duration cultivar while SML-668 offer competition to HHB-67 as SML-668 is tall and long duration, heavy branched variety which reduced the yield of HHB-67 which is short duration.

ECONOMICS

The intercropping systems sole mungbean SML-668 gave maximum returns (Rs.65006 ha^{-1}) was significantly higher than all other systems. However, among intercropping systems RHB-177+SML-668(1:2) gave significantly maximum net return (Rs.58664 ha^{-1}) but remained at par with HHB-67+SML-668(1:2) row ratio (Rs.58125ha^{-1}) in intercropping systems.

Table 1: Effect of different intercropping systems on yield attributes and yields of pearl millet and mungbean

Treatment														
	No. of effective tillers plant^{-1}	Ear head length (cm)	Test Weight (g)	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)	Number of pods plant^{-1}	Number of seeds pod^{-1}	Test weight (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
HHB-67 (Sole)	2.75	19.17	8.03	1503	3103	4606	32.63	---	---	---	---	---	---	---
RHB-177 (Sole)	2.88	19.68	8.04	1642	3167	4808	34.12	---	---	---	---	---	---	---
RMG-62 (Sole)	---	---	---	---	---	---	---	34.43	9.90	39.64	1040	2899	3939	26.40
SML-668 (Sole)	---	---	---	---	---	---	---	36.48	10.23	42.49	1142	3082	4224	27.03
HHB-67+RMG-62 (1:1)	2.98	21.04	8.00	1016	2164	3179	32.07	32.75	9.70	39.09	364	1027	1391	26.18
HHB-67+RMG-62 (1:2)	3.10	21.30	8.08	736	1631	2367	31.16	33.68	9.85	39.31	735	2051	2786	26.39
HHB-67+SML-668 (1:1)	3.05	21.15	8.05	972	2167	3139	30.97	34.40	10.18	42.14	387	1095	1482	26.11
HHB-67+SML-668 (1:2)	3.08	21.18	8.09	750	1792	2542	29.67	35.95	10.20	42.43	775	2108	2883	26.88
RHB-177+RMG-62 (1:1)	3.13	21.34	8.08	1028	2319	3347	30.71	32.65	9.45	39.10	356	997	1353	26.32
RHB-177+RMG-62 (1:2)	3.15	21.48	8.11	757	1708	2465	30.69	34.10	9.73	39.48	680	1877	2557	26.60
RHB-177+SML-668 (1:1)	3.13	21.35	8.10	1086	2167	3253	33.43	35.03	10.20	42.39	390	1096	1486	26.25
RHB-177+SML-668 (1:2)	3.15	21.62	8.13	785	1741	2526	31.15	36.15	10.23	42.45	781	2071	2852	27.37
SEm±	0.12	0.27	0.11	26.21	57.19	73.50	0.45	0.44	0.13	0.53	16.3	43	59.1	0.06
CD (0.05)	NS	0.78	NS	76	166	213	1.31	1.3	0.39	1.55	47	125	172	0.16

CONCLUSIONS

It was concluded from one year study that intercropping of pearl millet + mungbean RHB-177+SML-668 (1:2) row ratio produced maximum pearl millet equivalent yield, net returns and B:C ratio however, LER of HHB-67+RMG-62 (1:2) row ratio was higher among all the treatments. The study needs further confirmation for 2-3 years to draw recommendation.

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