International Journal of Agriculture, Environment and Bioresearch

Vol. 1, No. 01; 2016

www.ijaeb.org

ENHANCE THE PRODUCTIVITY OF PIGEON PEA THROUGH IMPROVED TECHNOLOGY

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ABSTRACT

The study was carried out by KVK during 2007-2010 with the help of farmers in the presence of concerning SMS at Sehore district under Vindhyan plateau agro climatic zone of Madhya Pradesh During these years of study on area 20 ha was covered under package demonstration on pigeonpea against their own problems with the number of 52 farmers is benefited under its technology. Maximum average yield, net return and minimize wilt incidence and pod borer damage 11.5 q/ha, Rs 16700/ha and 29.3% &37.2 respectively was obtained under scientific technology compared to farmers practices 8.4 q/ha and Rs 9587 and higher wilt incidence 41.2% and pod borer damage 79%. With its positive effect on yield attributes i.e highest number of pod /plant (82), number of grain/pod (3.2),Test weight (83g) and grain yield (11.5 q/ha), was observed under balance dose of fertilizers with the dual inoculation of Rhizobium and PSB @ 10g/ kg as seed treatment compared to farmers conventional practices number of pod /plant (73), number of grain/pod (2.7),Test weight (78g) and grain yield (8.5 q/ha). The maximum average cost benefit ratio was obtained 1:2.2 under improved technology compared to farmers' technology1: 1.7. The technology suitable for enhancing the productivity of pigeon pea crop. and calls for conducting of such demonstrations under the transfer of technology programme by KVKs or other TOT centers.

Keywords: Yield, C: B, wilt incidence, pod borer damage Technology gap and relative spread index

Introduction

Pigeon pea is grown throughout the India excepting the regions having very low temperature. Some state leading centre in terms of productivity of highest Gujarat (1059 kg/ha) next Uttar Pradesh 916 k/ha and third rank of Madhya Pradesh 780 kg/ha. Whenever National productivity of this crop is quite low 780 kg/ha to varietal potentional. The productivity levels of Sehore districts (916 kg/ha) is not discouraging. Because its productivity is much higher than National and state productivity. But their yield is quite low against they own yield potentional 1200-1500 kg/ha short duration variety and 2000-2500 kg/ha medium to long duration varieties. However

there is tremendous scope for increasing the production levels further provided due to attention is paid to the specific problem in its region i.e. Lack of high yielding varieties, imbalance use of fertilizers, seed replacement rate is very poor, use of seed without treated due to lack of knowledge about package and practices of pigeon pea cultivation. Whenever much extensive productive technology is now available this can boost pigeon pea production. But any viable and adoptive technology has not reached to growers. Under such circumstances KVK considering the systemic and concentrated efforts i.e. Use of improved variety, balance use of fertilizers and seed treatment is necessary to solve the major problems. Its agro technique suited to improving the yield under prevailing farming system through demonstration at farmers' field by the farmers in the presence of concerning SMS for realizing full yield potential of pigeon pea

Methods and material

The study was carried out by KVK Sehore (MP) during Kharif Season from 2006-07 to 2009-10 (Four consecutive years) in selected farmers field of three adopted village *viz*, Rola, Amalaramjipura and Bheelkhedi of Sehore Districts during these years of study on area of 20ha was covered under Front Line Demonstration with number of farmer 52 is benefited. Before conducting FLD a list of farmer prepared from group meeting and specific skill training was imparted in the selected farmer regarding different aspects of cultivation. In the demonstration one control plot was also kept where farmer practice was carried out. Under FLDs critical input modules developed and provided by KVK to selected farmers based on soil test report. Representative soil sample (0-15 cm deep) was taken from each selected farmers fields before the sowing of crop. The selected farmers field have medium to heavy black soil with $p^{H,}$ OC and EC ranging between 7.4-7.5, 0.5-0.56 and 0.31-0.6 respectively. And available nitrogen, phosphorus and potash varied between 230-232 kg/ha,12.8-18.5 kg/ha301-380 kg/ha respectively. The crop were sown second to last week of June. Row to Row and plant to plant distance 75 and 30 cm and fertilized of selected field as per recommendation 20:60:20 kg/ha NPK. Out of full dose of NPK applied at the time of sowing, plant protection measures and other agronomical practices were followed as per recommendation. To ensure wilt incidence and pod damage observation were taken on five randomly selected plants in each replication till harvesting the crop and percent pod damage and wilt incidence calculated by using following formula pod damage/wilt incidence (%) = No.of damage pod/plant /Total No.of pods/plant examined × 100. Data were collected from both the demonstration and farmer's practices with the help of personal contact and observations on yield data was also recorded at the time of separate threshing. And cost benefit ratio also computed in accordance to market price the pigeon pea and their technology gap, extension gap and technology index were worked out (Samai et al.2000) are as follows potential yield-demonstration yield, demonstration yield-farmers yield and technology gap/potential yield×100.The objective of the present study is to

investigate the change the traditional cultivation to scientific cultivation practices who will be beneficial in their life.

Result and Discussion

Result indicated that the yield of pigeon pea increased successively over the years in demonstration plots. During 2007 to 2010 the average demonstration yield was recorded to be 11.5 q/ha, it was noted highest yield 14.5 q/ha during 2009-10.The increase in percentage of yield was ranging between 34.3 to 40.0 during four years of study. The results clearly speak the positive effects of FLDs over the exiting practices towards enhancing the yield of pigeon pea in Sehore districts (MP) with its positive effect on yield attributes (table-2). The significantly highest number of pod /plant (82), number of grain/pod (3.2),Test weight (83g) and grain yield (11.5 q/ha), was observed under balance dose of fertilizers with the dual inoculation of *Rhizobium* and PSB @ 10g/ kg as seed treatment compared to farmers conventional practices number of pod /plant (73), number of grain/pod (2.7),Test weight (78g) and grain yield (8.5 q/ha). Biofertilizers and inorganic combination of nutrients supply may be synergistic and positively improves the physical and biological health of soil. The improvement of nutrient holding capacity and the aeration with the incorporation of biofertilizer was corroborated with the earlier findings of (Aulakh and Malhi 2005). The increased N, P and K content in soil and its supply proper as per need of crop due to supply both chemical fertilizers (N, P and K) and biofertilizers atm. Because of their associative effect plus solubilisation from non-exchangeable to labile form and fixitation of atmospheric N, which leads to significant increase in growth, and yield attributes as compared to single or un-inoculated plot. The increased availability of nitrogen and phosphorus in root zone of pigeon pea was favored by combined inoculation and has been reported in literature (Shivran DR and Ahlawat IPS 2000, Rudresh *et al.* 2005 and Singh RS and Yadav MK 2008). Further microbial decomposition and supply of latent energy brought about the transformation of inorganic nutrients held in the soil colloid in the non-exchangeable or fixed pool to readily utilizable labile pool form by growing plant. This was responsible for differences in plant vigor, which ultimately resulted in increased yield. The finding was in good accorded with the earlier reports of (Aulakh and Malhi 2005, Kale HB *et al* 2009, Goud VV and Kale HB 2010). The year-to-year fluctuations in yield and cost of cultivation can be explained on the basis of variations in prevailing social, economical and prevailing microclimatic condition of that particular village. Mukherjee (2003) has also opined that depending on identification and use of farming situation, specific interventions may have greater implications in enhancing systems productivity. Yield enhancement in different crops in Front Line Demonstration has amply been documented by Haque 2000, Tiwari and Saxena 2001, Tiwari *et al*. 2003 and Tomer *et al*. 2003.

Cost Benefit ratio

Economic analysis of the yield performance revealed that cost benefit ratio of demonstration plots were observed significantly higher (2.3, 2.1, 2.5 and 2.0) than control plots1.9.1.7.1.7 and1.6 respectively during 2007-08 to 2010-11. Hence, favourable cost benefit ratios proved the economic viability of the intervention made under demonstration and convinced the farmers on the utility of intervention. Similar findings were reported by (Sharma 2003 and Gurumukhi and Misra 2003) in in moth bean & sorghum. The data clearly revealed that the maximum increases in yield and cost benefit ratio were observed under recommended practices compared to farmer's practices. A similar result was also recorded by Goud VV and Kale HB (2010). The variation in cost benefit ratio during different years may mainly be on account of yield performance and input output cost in that particular year.

Extension Gap

The extension gap showed on increasing trend. The extension gap ranging between 2.4 to 4.1 q/ha during the period of study emphasize the need to educate the farmers through various means for the adaptation of improved agricultural production technique to reverse the trend of wide extension gap.

Technology gap

The trend of technology gap ranging between 8.5-10.6 q/ha respected the farmer's cooperation in carrying out such demonstration with encouraging results in subsequent year. The technology gap observed may be attributed to the dissimilarity in soil fertility status and weather conditions.

Technology index

The technology index showed the feasibility of the evolved technology at the farmers fields. The lower the value of technology index more is the feasibility of the technology. As such reduction in technology index from 42-53 % during 2007-08 to 2010-11 exhibitated the feasibility of the demonstrated technology in this region.

Wilt Incidence

The data regarding effect of seed treatment with fungicides *viz*., carbendazim + thiaram resulted in decrement of disease incidence (29.3%) as compared to farmers practices and highest average yield of 11.5 q/ha was recorded under this treatment. Thiram alone and in combination with Carbendazime is highly effective in inhibiting the mycelial growth of the pathogen and in reducing wilt incidence and increased seed yield accorded by (Nikam *et al*. 2007 and De RK *et al* 1996).Because its combination provides better protection against the disease and resulted in

29.3%. disease control over check., This may be attributed to the fact that seed treatment at the preliminary stages might have reduced the initial inoculums present in soil, thereby reducing the secondary spread of the disease. Our findings on the effectiveness of seed treatment with carbendazim +thiaram are similar to the results obtained by (Sugha *et al*. 1995, Singh and Sindhan 1998, Singh and Sandman 1998 and Poddar *et al.* 2004, MN Ingole *et al.* 2005, V K Mandhare and A V.Suryawanshi 2005)

Pod borer

Control of pigeon pea pod borers with insecticides were carried out during 2007-2010 in kharif season. Monocrotophos and quinolphos were most effective treatments in protecting the crop from pod borers and recorded 37.2 per cent reduced pod damage under scientific technology as compared to farmers' technology. Monocrotophos and quinolphos gave highest yield of 1150 kg/ha an increase of 35.3 per cent over control. Because under this combination ecofriendly management strategies were effective in reducing the pod damage caused by *Helicoverpa armigera* the regions for the superiority of chemical insecticides in reducing larval population and pod damage under this treatment is probably due to their quicker action against target pest. The variation of pod damage in yield in untreated plot might be due to either slow or not killing of insect. Under this combination it was reported that the reducing pod damage and increase yield this should be over weighed against the context of deleterious effect of synthetic chemical insecticides on the population of larva. These results are inconformity with the findings of OP Sharma *et al* (2011).

Impact of improved technology on farming community

During 2007- 08 to 2010-11total horizontal spread was increased 2.6 times and slightly changing of district cropped area of pigeon pea cultivated area and 1.13 times of the districts pigeon pea cultivated area ranging 16.5-32.6 % of the district and no change of relative yield index (Table-3). The drastic change of observed in percentage area under its variety (JA-4).The percentage area under the variety was increased 16.5-32.6 % during 2007-08 to-2010-11. It was noted that varietiey JA-4 were such type of varieties which dominate the Sehore district for adoption and yield in both the points. It is suggested that pigeonpea cultivar namely JA-4 totally adopted in sehore district and with the cultivation of these variety farmers can improve productivity with decreasing the cost because these lines are widely adoptable in nature and suitable for Sehore region.

Level of use and gap in adoption of pigeon pea technologies

Farmers in general use local varieties instead of the recommended improved varieties as the quality seed of improved varieties are not easily available (Table-5). Very few farmers were able to arrange improved variety seed. Farmers followed broadcast method of sowing against the recommended line sowing and because of this, they applied higher seed rate than the recommended. No NPK fertilizer was applied as recommended. Full gap was observed in case of irrigation and plant protection pigeon pea.

Weather data during crop season

Crop yield in different years is affected by technological gap and weather variability (table-6). The weather variables affect the crop differently during various stages of development. Which widely agreed to be reality, will have its adverse impacts on productivity of this crop. Under weather data temperature was noted at par during 2007-08 and 2008-09 at flowering to grain filling stage. But temperature was gradually decreased during 2009-10 at flowering to grain filling stage. And Maximum rain fall and number of rainy days was noted during this year which is beneficial for increase in crop production. Its due to maximum yield was found during 2009-10. Slightly rain fall and more number of rainy days is help of increase water use efficiency compared to heavy rainfall and less number of rainy days. Increased number of fruits setting due to reduce the shading of premature flower under continuously supply of moisture as per need of crop and high temperature at flowering to grain filling stage they reduces yield due to causing spikelet sterility and shortening the duration of grain filling phase. An increase in leaf surface temperature would have significant effects on crop metabolism and yield, and it may make crops more sensitive to moisture stress. Such type of situation recorded all year under demonstration except 2009-2010.Particularly weather factors like temperature, relative humidity and rainfall is directly or indirectly affected to crop yield supported by (Patel and Shekh, 2006).

Impact

The achievements and outcome of the organized FLDs programmers' rewading.Pigeonpea has registered significant increase productivity and B: C ratio. The mean yield of 52 FLDs conducted has exhibited 34.3-40.0% increased yield at different location against to farmer practice .Which is primarily due to release of high yielding and disease resistant varieties and improved technology against farmer practices. This technology adopted expected area of 2000 ha and obtained excepted 7800 quintals additional yield and in terms of expected money Rs 19,5,00,000 from its area. Its can possible by quickly spreading of this technology in Practicing farmers& farm women and RAEOs through training and provide literature related to package and practices of pigeon pea FLDs.

Conclusion

From the above findings its can concluded that use of scientific method of pigeon pea cultivation can reduce the technology gap to considerable extent thus leading to increased productivity of pigeon pea in the Districts. More over agencies in the districts need to provide proper technical support to the farmers through different educational and extension methods to reduce the extension gap for better pulse production in the districts The results of front line demonstrations convincingly brought out that the yield of pigeon pea could be increased by 34.5 to 40.0% with the intervention on balanced nutrition coupled with the insect pest management in the Sehore region. Favorable cost benefit ratio is self explanatory of economic viability of the demonstration and convinced the farmers for adoption of intervention imparted. The technology suitable for enhancing the productivity of pigeon pea crop and calls for conduct of such demonstrations under the transfer of technology programme by KVKs or other TOT centers.

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Table -1 Effect of improved variety along with package demonstration on pigeon pea.

Year	No. of demo.	Area ha.	Variety	Yield Potential q/ha	Yield		Increase yield %	Cost of cultivation		Grass return		Net return		B:C ratio	
					RP	FP		RP	FP	RP	FP	RP	FP	RP	FP
2007-08	13	5.0	JA-4	20.0	11.5	8.3	38.5	12500	11800	28750	20750	16250	8950	1:2.3	1:1.7
2008-09	13	5.0	JA-4	20.0	11.2	8.0	40.0	13400	12000	28000	20000	14600	8000	1:2.1	1:1.7
2009-10	13	5.0	JA-4	20.0	14.4	10.4	38.4	14000	12800	36250	26000	22250	13400	1:2.5	1:2.0
2010-11	13	5.0	JA-4	20.0	9.4	7.0	34.3	14500	13000	28200	21000	13700	8000	1:1.9	1:1.6
Mean					11.5	8.4	38.00	13600	12400	30300	21937.5	16700	9587.5	1:2.2	1:1.8

C:B ratio-Cost Benefit Ratio

Table-2 Effect of package on yield parameters of pigeon pea

Yields parameter	Years								
	2007-08		2008-09		2009-10		2010-11		CD & CV
	RP	FP	RP	FP	RP	FP	RP	FP	-
Plant population	5.3	5.5	5.3	5.5	5.3	5.6	5.2	5.5	-
No. of pods/plant	82	73	81	72	86	78	79	62	-
No. of grains/pod	3.2	2.7	3.2	2.6	3.8	2.9	2.9	2.7	-
Test wt(gm)	83.0	78	82	78	84.0	83	79.0	77	-

Yield(q/ha)	11.5	8.5	11.3	8.0	14.5	10.5	9.4	7.0	-

RP-Recommended practices, FP-Farmers practices

Table-3 Effect of package on extension gap and technology index and reduce of wilt and pod borer incidence.

Year	Extension gap	Technology gap	Technology index	Wilt affected plant/m^2		Damage %		Reduce damage % in	Damage pod borer/plant		Damage %		Reduce damage % in
				RP	FP	RP	FP	RP	RP	FP	RP	FP	RP
2007-08	3.2	8.5	42.0	0.29	0.44	5.1	7.4	31.08	8.7	15.2	9.6	17.2	44.1
2008-09	3.2	8.8	44.0	0.31	0.46	5.5	7.7	28.6	8.5	14.2	9.4	16.4	40.2
2009-10	4.1	9.6	48.0	0.25	0.36	4.5	6.0	25.0	8.1	13.5	8.6	14.7	41.4
2010-11	2.4	10.6	53.0	0.32	0.48	5.4	8.0	32.5	8.7	15.1	9.9	19.6	22.9
Average				0.29	0.43	5.1	7.2	29.3	8.5	14.5	9.4	16.9	37.2

Table-4 Impact of package on horizontal spread and relative spread index

Year	Horizontal Spread(000ha)	Districts cropped area in kharif(000ha)	Pigeon pea cultivated area of the districts(000ha)	% of pigeon pea cultivated area of the Districts	% of area under its variety	Relative yield index	Relative Spread index
2007-08	1.0	311.0	5.6	1.8	17.8	138.5	988.8
2008-09	1.5	309.0	4.6	1.5	32.6	140.0	2173.3
2009-10	2.3	314.8	9.6	3.0	24.6	139.4	2562.0
2010-11	2.6	350.7	15.7	4.4	16.5	134.3	3750.0

Table 5. Level of use and gap in adoption of pigeon pea technologies in Sehore.

Crop Operations	Recommended technologies	Existing technologies	Gap*
Variety	JA-4 (Medium duration)	Local (Sathia)	Full gap
Land preparation	One cultivator ploughing and 2 ploughings	One cultivator ploughing and 2 ploughings	Nil
Seed rate	@ 20 Kg/ha (JA-4 with line sowing)	@ 25 – 30 Kg/ha (broadcast tor without line sowing)	Use of higher seed rate and avoid line sowing
Seed treated	@ 2 g Carbendazim with @1 g Thaiaram/kg seed	No use of fungicides for seed treatment	Full gap
Fertiliser	DAP @ 125Kg/ha with dual inoculation of Rhizobium and PSB@ 10g/ Kg seed	DAP @ 30-35 Kg/ha without inoculation of culture	95-90 Kg DAP/ha, and No inoculation of culture
Weeding	Two mechanical weeding or Pendimethelin @ 3.3 litre/ha	Two mechanical weedings	Chemical weeding is not done
Irrigation	One irrigation in October last to November 1st fortnight (medium duration)	Nil	Full gap
Plant protection	First spray of Endosulphan (35 E.C.) 1.5 litre/ha and second spray of Monocrotophos (36 E.C.) 1.0 litre/ha *Gap	Nil	Full gap

Table -6. Weather data of crop season of pigeon pea during 2007-08 t0 2009-10

Month	Temperature						Humidity (%)			No. of Rainy day			Rain fall (mm)		
	Maximum			Minimum											
	2007-08	20008-09	2009-10	2007-08	2008-09	2009-10	2007-08	2008-09	2009-10	2007-08	2008-09	2009-10	2007-08	2008-09	2009-10
June	39.5	34.4	39.7	24.8	20.0	24.8	67	64.4	81.6	8	8	6	65.4	64.4	58.4
July	31.8	31.9	31.1	23.3	19.1	21.3	78	70	81.6	17	12	19	329.9	137.9	486.6
August	32	29.5	31.1	22.2	18.5	21.8	72	72.7	72.4	11	6	9	253.3	319.8	210.9

September	33.4	32.5	31.6	23.8	18.5	20.9	69	70.8	73.7	7	10	8	121.1	155.6	150.2
October	34.4	34.8	30.5	17.9	16.5	18.2	68	68.2	71.2	-	2	3	-	11.3	130.8
November	31.4	31.9	28.1	15.2	15.6	14.9	71	69.1	74.4	1	-	6	3.3	-	80.2
December	26.2	27.7	26.9	11.6	13.8	14.1	70	66	74.5	1	-	2	1	-	70.0
January	24.6	29	23.5	10.5	10.4	7.9	67	70	82.4	-	2	1	-	17.4	3