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Research Article

BOOSTUP PRODUCTION OF PIGEONPEA THROUGH SYSTEM OF PIGEONPEA INTENSIFICATION

RAI H.[1], KHARE S.K.[2]* AND SINGH S.K.[3]
[1]College of Agriculture, Tikamgarh, 472001, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, 482004, Madhya Pradesh, India
[2]ICAR-Krishi Vigyan Kendra, Nowgong, Chhatarpur, 471201, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, 482004, Madhya Pradesh, India
[3]ICAR-Krishi Vigyan Kendra, Tikamgarh, 472001, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Adhartal, Jabalpur, 482004, Madhya Pradesh, India
*Corresponding Author: Email - getsandipkumar@rediffmail.com

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Abstract: Pigeon pea is an important pulse among Indian consumers, who like more as Dal but its production is limited due to non-application of technologies in the field by farmers. A total number of 490 SPI technology demonstration with adjacent plot of local practices were conducted by Krishi Vigyan Kendra, Mandla (Zone-III, Northern hill of Chhattisgarh) the 145 villages in an area of 48 ha. farmers were selected through their knowledge basis. Out of nine parameters, fully gap was found in six parameters *i.e.*, using of traditional varieties & degenerated seeds, higher seed rate, no seed treatment, no plant protection measures and without use of inoculation. Whereas, partial gap was found in two parameters *i.e.*, Manures & Fertilizers and method of sowing and spacing, no gap was found in land preparation. Average plant height varied from 246 cm to 336 cm in SPI technology whereas in traditional method it was 165cm to168 cm. Mean of three years revealed that 1626 pods/plant was observed in SPI technique as against 103 in farmer's practice. Yield/ plant was found 490 to 598 gm./plant in SPI technique whereas 43 to 56 gm./plant in farmer's practice. SPI technique was really showed better response in all yield attributing characters in all respects. Yield of 40 SPI technique demonstration ranged from 15.98 to 16.86, q/ha as against 7.78 to 7.89 q/ha in traditional/ farmers practice. The percent yield increase over farmers practice was 64.02% to 78.35% higher over farmers practice (FP). Cumulative Pooled mean of three years shows 16.39 q/ha in SPI technique as against 8.08 q/ha *i.e.*, higher 71.70% over farmer's practice.

Keywords: *Tur, Dal, Planting*

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Introduction

Pigeon pea (*Cajanus cajan* [L.] Millspaugh) is commonly known as red gram or tur is a very old crop of this country. After gram, arhar is the second most important pulse crop in the country. It is mainly eaten in the form of split pulse as 'dal' serving as a lifeline in tropical and subtropical regions of Asia. Pigeon pea is cultivated in an area of 6.97 m ha with a production and productivity of 5.05 mt and 724 kg/ha, respectively [1]. Seeds of Arhar are also rich in Protein22.3%, Fat 1.7 %, Minerals 3.5%, Fiber 1.5 %, Carbohydrate 57.6 %, Calcium 73 mg/100 g, Phosphorus 304 mg/100g, Iron 5.8 mg/100g, Moisture 13.4 % and Calorific value 335 Kcal/100g, Iodine, essential amino acids like lycine, threonine, cystine and Arginine etc. are also found in little quantity. India ranked first in area and production in the world with 79.65% and 67.28% of world's acreage and production respectively. The productivity of India was 587 kg/ha [2]. During Twelfth Plan, the country's total area coverage and production of tur were 38.49 lac hectares and 28.66 lack tones respectively. Madhya Pradesh ranks 2nd in production (15.87%) [3]. India sharing about 25 % (22.43 million tons) of pulse area in the world's pulse production out of 33.6 % (13.1 million tons) of worlds pulse. Among the 70% of global share of chickpea and pigeon pea production goes to India. Arhar is an important pulse among Indian consumers, who like more as Dal to arhar but the limiting the production of pulse because of plant establishment method and other concerned technologies that are not applied thoroughly. Pigeon pea is sensitive crop against adverse climatic condition comes after germination and during vegetative stages which slash the production of arhar again. The gap between the production and consumption is really big question for our country and we have to import pulse from other countries. The estimated requirement of pulses 27.00 million tons by 2015 AD is challenge.

These all aspect of production constraints in country, it needs boosting up the pulse production through new innovative techniques to come the real compensative figure of production. In *kharif* season, those regions receive higher rainfall in initial month of monsoon. It is very difficult to manage the waterlogged condition for seeding of Arhar crop due to high marshy condition of beds. Again, farmers can't re-sow the arhar due to costly seed and delayed time of sowing. These all factors emphasized to popularise the system of pigeon pea Intensification technique.

Materials and Methods

A total number of 490 SPI technology demonstration with adjacent plot of local practices were conducted by Krishi Vigyan Kendra, Mandla (Zone-III, Northern hill of Chhattisgarh) in the 145 villages in an area of 48 ha. The pigeon pea growers were selected through their knowledge basis. Cultivation of improve variety of pigeon pea of TJT-501 was grown with transplanting method. Krishi Vigyan Kendra are grass root level organization meant for application of new technologies through assessment, refinements and dissemination under different micro farming situation in the district. Present investigation was carried out to study the Performance of pigeon pea with System of pigeon pea Intensification (SPI) at farmers field. The Soil of the demonstrated area was light and undulated topography. Seed was socked in a mixture of normal water, cow urine, jaggery and vermiwash, for 6-8 hours after separating seed from the mixture, Trichoderma @ 10 g, *Rhizobium* 20g and Phoshorus soulblizing bacteria (PSB) 20g /kg of seed was mixed. The nursery raising programme was started in last week of May for *kharif* season of 2012-13, 2013-14 and 2014-15.

Table-1 *Gap analysis of Pigeon pea cultivation between SPI and farmers practices*

SNo	Technologies	Demonstration Practices	Farmer's practices	Gap
1	Land preparation	Two ploughing and pits digging	Two ploughing	Partial gap
2	Variety	TJT-501	Bagani Arhar local variety and seed	Full gap
3	Seed rate (kg/ha)	2kg/ha	30-40 kg/ha	Full gap
4	Seed treatment	Seed was socked in a mixture of normal water, cow urine, jaggery and vermiwash, for 6-8 hours after separating seed from the mixture, Trichoderma @ 10 g, *Rhizobium* 20g and Phoshorus sulbulizing bacteria (PSB) 20g /kg of seed was mixed g/kg seed	No seed Treatment	Full gap
5	Nursery raising and transplanting method & Spacing	nursery was prepared in Poly bag and after 30-35 days old seedlings were transplanted in main field with spacing of 100X100 cm row x plant	Direct seeding by broad costing method with kodo, Kuttki, Jowar and Maize	Fully gap
6	Manures & Fertilizers	500 kg FYM/ vermicompost +20:60:20:40 NPKS kg/ha	Little amount about 25-30kg/ha of DAP imbalanced fertilizer dose	Partial gap
7	Weed management	One hand weeding at 30-35 DAT	No weeding	Fully gap
8	Plant Protection measure	Need based plant protection measures were adopted	No plant protection measures were adopted	Full gap
9	Inoculation	6kg *Rhizobium* +6kg PSB mixed with 2qt. FYM/ Vermicompost /ha.	Not inoculation	Full gap

Table-2 *Mean of Yield attributing characters influenced by System of Pigeon pea Intensification (Mean of 48 ha. of each year)*

Yield attributing characters	2012-13		2013-14		2014-15		Total		Mean	
	FP	SPI	FP	SPI	FP	SPI	FP	SPI	FP	SPI
Plant height (cm)	165	250	170	246	168	236	503	732	168	244
No. of branches/plant	04	11	06	13	05	16	15	40	05	13
No. of Pods/plant	98	1632	85	1580	125	1668	308	4880	103	1626
Yield/Plant(g)	46	490	43	562	56	598	145	1650	48.33	550
Yield (q/ha)	7.78	16.86	8.56	15.98	7.89	16.32	24.23	49.16	8.08	

Table-3 *Productivity, extension gap, technology gap and technology index of Pigeon pea as grown under SPI and Traditional practice*

Year	Area	No. of	Variety	Average yield (qt/ha)			Increase yield over F.P. (%)	Extension	Tech.gap	Yield
	(ha)	FLD's		Potential	SPI	Farmers		Gap (qt/ha)	(qt/ha)	Index (%)
2012-13	16	40	TJT-501	11.59	16.86	7.78	78.35	9.08	5.27	0.45
2013-14	16	40	TJT-501	11.59	15.98	8.56	64.02	7.42	4.39	0.38
2014-15	16	40	TJT-501	11.59	16.32	7.89	72.72	8.43	4.73	0.41
Total	48	120	------	-------	49.16	24.23	215.11	24.93	14.39	1.24
Average	16	40	------	-------	16.39	8.08	71.7	8.31	4.8	0.41

Table-4 *Profitability of pigeon pea grown under SPI technology and Traditional practice/ farmer's practices*

Year	Average cost of cultivation (Rs./ha.)		Average gross return (Rs./ha.)		Average Net Return (Rs./ha.)		B:C Ratio	
	SPI	FP	SPI	FP	SPI	FP	SPI	FP
2012-13	26300	16500	84300	38900	58000	22400	3.21	2.36
2013-14	26700	17000	79.900	42800	53200	25800	2.99	2.52
2014-15	27200	17800	81.600	39450	54400	21650	3.00	2.22
Total	80200	51300	245800	121150	165600	69850	9.2	7.10
Average	26733	17100	81933	40383	55200	23283	3.06	2.37

A mixture of soil and FYM (75:25) have been prepared and kept in a poly bags size 6"x4" size of near about half kg in which one seed of variety TJT-501 was sown and kept in safer places, it was irrigating regularly an interval of 24 hrs. depending upon the climatic condition. Sown seeds were germinated after 3rd-4th days and hardening of plants needed 30-35 days. When seedling became hard at 8-10 leaves stage, it was appropriate time for transplanting in main field, where 12"x12"x12" pits were prepared at a wider spacing of 100 cm x100 cm rows x plants. Before onset of monsoon, 50:50 soil and 500 kg FYM / vermin compost + 20:60:20:40 NPKS kg/ha mixture was filled in the pits All fertilizers were given as basal dose. After first monsoonal rains plants were transplanted into the pits after removing of poly bag. In this technology less quantity of seed required in comparison to normal sowing *i.e.*, 1.5 to 2.0kg/ha. in between 20 to 60 days of plantation three times nipping was done. This technology is very suitable and useful for small and marginal farmers. The observations were taken from 10 randomly selected plants in each plot on different aspects. Field days and group meetings were also organized to provide the opportunities for surrounding farmers to witness the benefits of demonstrated technology. Data were collected by KVK, scientists. The crops were harvested after 180-190 DAT at maturity stage. The following parameters *viz.*, Technological gap between the potential yield and demonstrated yield, extension gap between demonstrated yield and farmers yield, technological index and seed yield under existing practices were calculated with the help of formulas given by Samui, *et al*., (2000) [4].

% Increase in yield over F.P. = [(Demonstration yield – Farmer practice yield) / (Farmer practice yield)] × 100

Technological gap = Potential yield - Demonstration yield
Extension gap = Demonstration yield- Yield under farmer practice
Technological index (%) = [Technology gap / Potential yield] X 100
Cost benefit (B:C) Ratio = Gross return / Gross cost

Results and Discussion

Gap analysis between SPI and farmers practices

On the basis of pigeon pea cultivation, data collected from the farmers given in [Table-1] revealed that out of nine parameters, fully gap was found in seven parameters *i.e.*, using of traditional varieties and degenerated seeds, higher seed rate for more than 15 times (very dense plant population) and method of sowing, no seed treatment, no plant protection measures and without use of inoculation. Whereas, partial gap was found in one parameters *i.e.*, Manures & Fertilizers and spacing, no gap was found in land preparation.

Yield attributing Characters

Yield attributing characters [Table-2] revealed *i.e.*, like plant average height was observed 250, 246 and 336 cm /year during 2012-13, 2013-14 and 2014-15 in SPI technology whereas in traditional method it was 165,170 and 168 cm respectively. Pooled height of three years was 244 cm in SPI technique as against 168 cm in traditional practice/ farmer's practice. Number of branches/plant 11, 13 and 16 in SPI technique as against 04, 06 and 05 branches in traditional practice. Mean of three years no. of branches indicate that13 branches in SPI and 05 branches in farmer's practice.

Numbers of pods/plant was1632, 1580 and1668 pods/plant in SPI technique while 98,85and 125 pods/plant in farmer's practice. Mean of three years revealed that1626 pods/plant was observed in SPI technique as against 103 in farmer's practice. Weighing of yield/ plant was found 490, 562and 598 gm./plant in SPI technique whereas 46, 43 and 56 gm./plant in farmer's practice. SPI technique was really shows for better response in yield attributing characters in all respect. Doni planting with scooping was really the higher values for growth and yield attributing characters which lies under the effect of different treatment [5].

Productivity, extension gap, technology gap and technology index of Pigeon pea as grown under SPI and traditional practice

[Table-3] revealed that average yield of 40 SPI demonstration shows 16.86, 15.98 and 16.32 q/ha received from SPI technique as against 7.78, 8.56 and 7.89 q/h in traditional/ farmers practice. Pooled mean of three years shows 16.39 q/ha as against 8.08 q/ha *i.e*., higher 71.70% over farmer's practice. The yield enhancement due to SPI technological intervention was 78.35%, 64.02% and 72.72% higher over farmers practice (FP) in respective years. SPI technology was found to be higher in all the manners in all the years, as compare to farmer's practices under demonstrated plot, Khatoon, *et al.,* (2018) [6] and Mahajan, *et al*., (2014) [7] reported that the rice variety MTU-1081 planted with SRI method gave significantly higher yield, the finding is similar to pigeon pea .The cumulative effect of the technological intervention over three years, revealed that on an average yield of 16.39 q/ha was recorded which was 71.70 % higher over FP. Extension gap q/h indicate that 9.08, 7.42 and 8.43 average of three years shows 8.31q/ha. Technological gap revealed that +5.27, + 4, 39 and + 4.72 q/ha higher from potential yield of the variety average of technology gap + 4.80 q/ha indicate that technology provide more yield than potential yield. Percent yield index was also higher +0.45, +0.38 and +0.41 over farmers practice, mean of three years indicate +0.41% over farmers' practice.

Profitability of SPI technology and Traditional practice of pigeon pea

Average cost of cultivation, average gross return, average net return and B:C ratio was worked out as above-mentioned formulae.

Cost of cultivation

Cost of cultivation of SPI technique and traditional practice is mentioned in [Table-4] revealed that Rs.26300,26700 and 27200/- ha^{-1}. in SPI technique as compare to farmers practice Rs.16500/-, 17000/- and 17800/-ha^{-1}. in traditional practice Pooled mean indicate that higher cost Rs.26733/-ha^{-1} in SPI Technique and 17100/- ha^{-1} in traditional practice.

Average gross Return Rs./ha^{-1}

The average gross return Rs. 84300/- 79900/- 81600/- ha^{-1} in SPI technique as against RS.38900/- 42800/- and 39450/- ha^{-1} in farmer's practice. Pooled mean of three years indicates that Rs.81933/- ha^{-1} in SPI and Rs.40383/- ha^{-1} in farmers practice was just half of SPI technique.

Net Return and B:C ratio

The yield performance and economic indicators are presented in [Table-4]. The data revealed that net return Rs.58000/-, 53200/- and 54400/- ha^{-1} was found in SPI while Rs.22400/- 25800/- and 21650/-ha^{-1} in farmers practice, yield of all SPI demonstrated plots of Pigeon pea was found to be higher in all the manners in all the years. The SPI package of practices was higher as compare to farmer's practices. Under demonstrated plot, the performance of arhar yield was found to be just double to farmer's practices during three consecutive years. The B:C ratio of SPI technology was found 3.21, 2.99 and 3.00 where as in farmer's practice it was 2.36,2.52 and 2.22. Pooled mean of three years revealed that 3.06 in SPI and 2.37 in farmers practices. Yield of Arhar variety TJT-501 was recorded, 16.86, 15.98 and 16.32 q/ha respectively during 2012-13, 2013-14, and 2014-15.

Conclusion

Pigeon pea is one of the most important pulse crops of India sharing 63% of World production. There is a huge gap between production and consumption for which nation has to import from other countries. Hence to boost up the production of pigeon pea, demonstration on large scale (48 hectare) were carried out on farmers field in three consecutive years (2012-13, 2013-14 and 2014-15). System of Pigeon pea Intensification (SPI) with the variety TJT-501 was demonstrated and it showed good result *i.e*., average plant height 244 cm, No. of branches 13, No. of pods 1626 and finally 550 gm./plant yield as comparison to traditional practice *i.e*., plant height 168 cm, 05 branches/plant, 103 pods/plant and 48gm.yield/plant. Pooled mean of extension gap, technological gap and yield index was 8.31(q/ha), 4.80(q/ha) and +0.41 % respectively. Average cost of cultivation Rs.26733/-ha in SPI while Rs.17100/- in farmer's practice. Average gross return, Net return and B:C ratio was Rs. 81933/- ha, Rs., 55200/- ha and 3.06 in demonstrated practice as against Rs.40383/- ha, Rs. 23283/- ha and 2.37 in farmer's practice.

Application of research: Study of Boostup Production of Pigeonpea

Research Category: SPI technology

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****Principal Investigator or Chairperson of research: Dr Sandip Khare**
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Study area / Sample Collection: Krishi Vigyan Kendra, Mandla (Zone-III, Northern hill of Chhattisgarh)

Cultivar / Variety / Breed name: Pigeon pea (*Cajanus cajan* [L.] Millspaugh)

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.
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References

[1] FAO STAT (2016) Mushrooms and truffles. Rome: Food and Agriculture Organization of the United Nations. http://faostat3.fao.org/(Accessed August, 2016).
[2] FAO STAT (2014) Mushrooms and truffles. Rome: Food and Agriculture Organization of the United Nations. http://faostat3.fao.org/(Accessed August 1, 2014).
[3] Anonymous (2015-16) Agricultural Statistic at a glance, Department of Agriculture and cooperation, Directorate of Economics and Statistics, Ministry of Agriculture and Farmer welfare, Government of India. Anonymous (2015-16) 3rd Advance estimates of area, production and yield of mustard. Department of Agriculture, Govt. of Rajasthan.
[4] Samui S.K., Maitra S., Roy D.K., Mondal A.K. and Saha D. (2000) *J. of Indian Society of coastal Agricultural research*, 18(2), 180-183.
[5] Pradhan A., Thakur A., Sao A. and Patel D.P. (2014) *Int. J. Curr. Microbiol. App. Sci.*, 3(1), 666-669.
[6] Khatoon R., Kurmvanshi S.M. and Namdeo K.N. (2018) *Annals of Plant and Soil Research*, 20(3), 307-309.
[7] Mahajan G., Mishra C.M., Dubey D.P. and Engla R. (2014) *Environment and Ecology*, 32(3A), 1137-1140.