Indian Journal of Extension Education
Vol. 54, No. 4, 2018 (33-37)

Yield Maximization of Pigeonpea under Erratic Situation of Climate through Innovative Technology System of Pigeonpea Intensification

[1]R.K. Singh, [2] S.R.K. Singh, and [3]U.S.Gautam

ABSTRACT

The field experiment was conducted at farmer's field and KVK Instructional farm of *Panna* district of Madhya Pradesh. Majority of the farmers in this region are still cultivating the traditional practices/ varieties along with higher seed rate without the arrangement of row and plant spacing during kharif season, therefore plant population was not maintained as per recommendation under erratic rainfall, which causes reduced production as well as higher cost of production. Under such circumstance maintaining adequate number of plants by transplanting of young seedling of pigeon pea in presence of both a biotic and biotic stresses. Counter of this problems and exploit full potential through certain crop contingencies including transplanting of pigeon pea seedling in main field so as to maintain adequate plant population for compensating yield loss during *Kharif* season. Resulted that average higher yield, Net return and cost benefit ration was found in both year 13.9 q/ha, ₹ 25815, B:C ratio 1:2.0 respectively under transplanting of pigeon pea seedling as compared to farmers practices 9.6 q/ha, ₹ 15600, B:C ratio 1:1.96 respectively. Farmers responded positively to the results of the demonstration and those who participated in the demonstration trainings were willing to adopt System of Pigeon pea Intensification. And scientist advises to adoption of this module for small and marginal farmers with less land to take advantage of this method can yield dramatic results with less number of seeds and saving of water and nutrients.

Key words: B:C ratio, Net return transplanting and yield

INTRODUCTION

Pigeonpea is commonly known as commercial crop for rain fed /dry land area of Panna district in Kymore plateau and Satpura hills agro climatic zone of Madhya Pradesh. The district is considered as the pulse bowl of Madhya Pradesh as different pulses are grown here. Among the pulses, the pigeonpea is an important pulse crop being cultivated in 3.8 million hectares with an annual production of 2.4 million tons in India. However, national productivity of pigeon pea is quite low (780 kg/ha) as against their yield potential. In contrast, the productivity of pigeon pea crop in Panna district of Madhya Pradesh is about 953 kg/ha which is slightly greater than the national productivity, however lesser than the yield potential of the crop. There are several constraints for low productivity of pigeonpea in Panna district such as maximum area under rain fed/erratic climatic conditions, sowing of pigeonpea through broad casting /line sowing without the arrangement of row and plant spacing. Sowing of pigeonpea is mostly either early or late due to early/late onset of monsoon. Therefore germination and growth was adversely affected by moisture stress or excessive moisture. Besides these if sowing of pigeon pea at late onset on monsoon then poor growth and development of

[1]Scientist (Agro.) KVK, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Krishi Vigyan Kendra Panna [2]Principal Scientist (Ext.) ZPD Zone-VII Jabalpur, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Krishi Vigyan Kendra Panna [3]Director ATARI Zone –II Kanpur, U.P.

plant canopy and late maturity of this crop. This was adversely affected by frost during last week of December to first week of January month. During Kharif season in Panna district, pigeon pea crop was suffered with moisture stress under long period dry spell or excessive moisture under heavy precipitation and frost at flowering to pod formation stage. These are several constraint for low productivity in pigeonpea due to low plant population in both situations. The excess moisture or moisture stress conditions during monsoon season creates unfavorable conditions for its growth by reducing aeration, nutrient uptake, nodulation, and creates favorable environment for disease incidence resulting in reduced crop stand and poor yield (Kantwa *et al.* 2006). As a consequence of both abiotic and biotic stresses and seedling mortality, the plant population gets considerably reduced (Poornima 2009, Praharaj 2013). Thus, maintaining adequate plant population in presence of both *abiotic* (excess soil moisture, reduced aeration, severe weed competition and nutrient stress) and *biotic* stresses (hampered nodulation and biological N fixation, seedling blight and wilt) by transplanting of pigeonpea seedling. And overcome of another constraint is delayed planting due to late onset of monsoon. In this circumstance catch the time between early and late by sowing of early pigeonpea seedling in polythine bags for timely planting. In this situation Krishi Vigyan Kendra Panna introduce the production technique of system of pigeon pea intensification along with medium duration variety (TJT-501 and Shivana). In this methods Pigeonpea transplanting is such a strategy towards fulfilling this objective of maintaining a good initial plant stand during early in the season for improving its productivity wherein seedlings are raised in the polythene bags in nursery and transplanted in the main field after a certain age. As established seedlings, these picks up growth quickly under field condition and can be more competitive in both situations. And transplanting of pigeonpea seedling with medium duration variety is one of the good option for a biotic and biotic stress. Therefore, to study the effect of transplanting of pigeonpea technology on yield, economics and adoptability considerations.

METHODOLOGY

The field experiment was conducted at farmer's field and KVK Instructional farm of Panna districts of M.P. The experiment was laid out in randomized block design with observation through three replication. Two sowing methods are Broad casting/ line sowing and transplanting of pigeonpea seedling with Pigeonpea seeds were treated with *Rhizobium* and PSB @ 5g/kg seed separately before sowing. For raising of seedlings the following practice was adopted. Pigeonpea seeds were sown in black /white polyethylene covers (size 20 x 8 cm with embedded holes) during July by filling soil and well decomposed farm yard manure (FYM) at 2: 1 ratio; and regular watering was done to raise seedlings upto 4 weeks (as per treatment) in the nursery. After germination, only one seedling per bag was maintained by thinning at 10 days after sowing (DAS). On the day of transplanting, varying age of pigeonpea seedlings 4 weeks of seeding were transplanted at a row spacing of 100 x 50 cm. Conventional direct line sowing at main field was taken as a control plot. Transplanting of pigeonpea at 15-20 cm ridges were made as per treatment on separate plots and then pigeonpea seedlings were transplanted after removing the polythene cover without disturbing the soil near root zone of the pigeonpea seedling. Well decomposed FYM @ 5 t/ha was applied two weeks before sowing in the entire field and incorporated into the soil for better crop survivability. And application of half dose of recommended fertilizers of N:P: K, 20:60:20 kg/ ha. Application of ½ full dose of required fertilizers at the time of field preparation Furrow irrigation was applied at both branching and pod development stages depending upon deficit of rainfall during these stages. Normal practice of crop husbandry was followed for a successful crop raising. The crop was harvested during mid January in 2015 and 2016. Data was observed on yield and yield attributes, economics during both the years were subjected for appropriate statistical analysis and interpretation.

RESULTS AND DISCUSSION

The maximum mean yield (13.9 q/ha) was found in both year under system of pigeonpea intensification by transplanting of pigeonpea seedling as compared to direct seeding of pigeonpea seeds (9.6 q/ha). The higher yield in altered transplanting of pigeonpea seedling technology can be accounted for the cumulative effect of yield and yield attributes like- number of pods/plant (126.5) and number of grain/ pod (5) and test weight (109.5 g) as compared to direct seeding of seeds (59.5, 3.0, 106g) respectively. Because maintaining adequate plant population in presence of both *abiotic* (excess soil moisture, reduced aeration, and severe weed competition) and *biotic* stresses (hampered nodulation and biological N fixation, seedling blight and wilt) pose a major challenge which needs to be tackled up strategically. Another constraint is delayed planting due to late onset of rains in traditional practices. In this situation seedling of pigeonpea is good option for capture the time in nursery and they good performance in late onset of mansoon. On the contrary, early sowing of pigeonpea ensures higher yield (Shankaralingappa and Hegde, 1989) as it ensures in providing opportunity for full vegetative growth of pigeonpea crop. The higher productivity of the System of pigeonpea intensification may be attributed to efficient use of available resources in the absence of any competitor under wider spacing. And dry matter production per unit of photosynthetic active radiation (PAR) absorbed was higher than the traditional practices. The higher PAR conversion efficiencies under proper spacing between plant and row may be attributed to greater spread and distribution of light over leaf area of crop canopies during vegetative growth stage. Similar observations were also recorded by Muoneke *et al*., (2007) and Singh *et al* (2014).

Economic impact of the technology

Adoption of improved production technology system of pigeonpea intensification along with improved variety (Shivana and TJT-501) of pigeonpea crop and received the higher production (13.9 q/ha) as well as net income and cost benefit ratio ₹ 25815/ ha and 1:2.4 respectively as compared to traditional system of farming (9.6 q/ha, ₹ 15600/ha and 1:1.95 respectively). Thus cultivation of pigeonpea crop using improved cultivar (TJT-501 and Shivana) along with appropriate production technology (SPI) brought out the changes in social and living status of the farmer. Similar growths were also recorded in other crops which also impart improvement in economic condition of the farmer by providing technical assistance by the scientists of KVK at regular interval.

Impact of technology

The achievements and outcome of this technology are outstanding. Pigeonpea has registered significant increase in productivity and returns per rupee investment. The average yield under this technology of pigeonpea has exhibited 43.9 per cent increase in yield against to farmers practices. This is primarily

Table 1: Yield and yield attributes of pigeonpea.

Treatment/particulars	2014-15		2015-16		Mean data of both year	
	Improved practices	Farmers practices	Improved practices	Farmers practices	Improved practices	Farmers practices
Technology used	Improved variety (TJT-501) along with system of pigeonpea intensification	Traditional sowing methods along with long duration old variety	Improved variety (Shivana) along with system of pigeonpea intensification	Traditional sowing methods along with long duration old variety	Improved variety (Shivana & TJT-501) along with system of pigeonpea intensification	Traditional sowing methods along with longduration old variety
No. of pods/plant	123	58	130	61	126.5	59.5
No. of grains/pod	5	3	5	3	5	3
Test weigh (g)	109	107	110	105	109.5	106
Yield q/ha	13.4	9.6	14.3	9.6	13.9	9.6

Table 2: Economic impact of system of pigeonpea intensification.

Treatment/particulars	2014-15		2015-16		Mean value of both year	
	Improved practices	Farmers practices	Improved practices	Farmers practices	Improved practices	Farmers practices
Technology used	Improved variety (TJT-501) along with system of pigeonpea intensification	Traditional sowing methods along with long duration old variety	Improved variety (Shivana) along with system of pigeonpea intensification	Traditional sowing methods along with long duration old variety	Improved variety (Shivana & TJT-501) along with system of pigeonpea intensification	Traditional sowing methods along with longduration old variety
Cost of cultivation Rs/ha	19300	15600	19300	15600	19300	15600
Gross return Rs/ha	44480	30720	45750	31680	45115	31200
Net return Rs/ha	25180	15120	26450	16080	25815	15600
B:C ratio	1:2.3	1:1.9	1:2.4	1:2	1:2.4	1:1.95

due to introduction of innovative improved technology along with disease resistant variety for higher yield against farmer practices as cited by Singh *et al*. (2013). But now a day necessary for effective dissemination of improved technology along with medium duration improved variety (TJT-501 and Shivana) of pigeonpea crop by bringing awareness among farmers and farm women along with RAEO of the village through various field oriented activities, training programme and availability of literature related to package and practices of pigeonpea crop.

Feed back of pigeonpea growers through system of pigeonpea intensification

Good performance of the technology was observed by farmers during evaluation/ assessment of the technology. And farmers was obtained expected return from the technology system of pigeonpea intensification. For getting feedback about the technology from 11 benefited farmers were interviewed through comprehensive questionnaire in the study area. Because this technology has tolerance to biotic and a biotic stress therefore, it was found suitable in terms of increased profitability and reduced risk. The farmers decided to switch off their own practices and varieties and were inclined for adoption of this improved technology along with medium duration variety. Scientists should get insights about the level of adoption and the underlying factors that constraint or facilitate the adoption process, it is useful to examine the factors that determine technology uptake. This information is important to both researchers and policy makers. The researcher would gain useful feedback on the level of uptake of the variety/technology by the pigeonpea growers and the attributes of the technology that conditioned the level of adoption. This can be useful in making decision to develop well-suited technology/variety that meets the needs of the target of increasing population in future. Policy makers can use such information to reform the policies that slower down the technology uptake or formulate and implement new instruments that hasten and support the adoption process.

The study also suggests that similar kind of approach can effectively convince the other farmers in other villages to adopt improved technology/ variety (TJT-501 and Shivana) with recommended package of production to optimize their productivity which may effectively contribute to increase the national production of pigeonpea.

CONCLUSION

Yield and net return maximization in per unit area of pigeonpea through a new concept on low input technology is known as System of pigeonpea intensification for increasing their yield. Because System of pigeonpea intensification has a number of advantages and includes the need for less number of seeds for sowing, low use of water and nutrients, easy in sowing by manual dibbling in poly bags and harvesting more production. Besides these its technique is suitable in both abiotic and biotic stresses. Because seedling mortality is negligible due to transplanting of young seedling of pigeonpea, Thus, maintaining adequate plant population/crop productivity in presence of both *abiotic* (excess soil moisture /ponding water, reduced aeration, severe weed competition and nutrient stress) and *biotic* stresses (hampered nodulation and biological N fixation, seedling blight and wilt). Therefore advises to adoption of this module for small and marginal farmers with less land to take advantage of this method to increase yield with less number of seeds and saving of water and nutrients.

Paper received on : February 16, 2018
Accepted on : February 28, 2018

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