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Assessment of Yield Performance Through Front line Demonstrations of Pigeonpea (*Cajanus Cajan* [L] Millsp) in Sitapur District of U P

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Abstract

Study was under taken in Sitapur district of U.P. in central India. This state has record yield potential of the crops but, there is yield gap between farmers yield and yield potential of pulse crops due to unawareness about potential variety(s), use of poor quality and inadequate seed, conventional cultivation practices and poor crop management practices. The yield performance of pigeonpea was studied through front line demonstration in the year 2012-13, 2013-14 and 2014-15. Existing farmers practice was taken as a control for comparison and recommended HYVs of pigeonpea Narendra Arhar-1 (NA-1) along with soil test value based fertilizer application and integrated crop management practices. The forty eight front line demonstrations covering 15.65 ha area were conducted. The study reveals that an average yield of pigeonpea under demonstration plot was fetched 2.24 t ha^{1} lowest in farmers practices (control plot) 1.53 t ha^{1} hence, 46.08 per cent yield was increased over control. The average technology gap was recorded 0.76 t ha^{1}, average extension gap 0.71 t ha^{1} and average technology index was recorded 25.33 per cent.

Keywords: Extension gap; Front line demonstration; Pigeonpea; Pulses; Technological gap; Technological index; yield.

Introduction

Pigeonpea (Tur) is a drought tolerant multipurpose grain legume crop cultivated in area of 4.78 million ha, production 3.59 M t and yield 751 kg ha^{-1} by the resource poor smallholder farmers in marginal farming systems in the Indian subcontinent. Its alone adds >50% in total pulse production (Kharif) in our country. The state of U.P. having an area under the pigeonpea crop 0.25 M ha, production 0.27 M t and yield 1084 kg ha^{-1} which contributes 5.26% and 7.58% in total area and production of pigeonpea at national level. (https://eands.dacnet.nic.in/PDF/At%20a%20Glance%202019%20Eng.pdf). The protein-enriched seed of pigeonpea is the principal dietary protein source for an estimated 1.1 billion people. The pulse crop are very much fit for inter and mixed cropping system that is why they have the multidimensional scope in all type of climatic situation of our country. Legumes crops are the gift of nature which play very important role in nitrogen fixation, soil fertility management, biomass enhancement, ecosystem, soil temperature and, reduce soil degradation and also helpful in improving the organic matter of soils where they are grown as single or intercropping based cropping system (*Singh*

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et. al, 2016). The gap between present productivity and potential of variety may be due to improper implementation of crop production technologies like non improved varieties, use of more seed rate, poor insect-pest management, faulty row spacing, traditional broadcasting, non recommended dose of fertilizers, low use of organic manure, and less in-situ weed management practices etc. these said faulty crop production practices were used by farmers even till date. To improve their production and make them aware of recommended pigeonpea production technologies the field demonstrations were laid out by scientists of Krishi Vigyan Kendra-II of Sitapur to initiate and disseminate the improved high yielding variety of pigeonpea among farming community to boost the crop yield during 2013-14, 2014-15 and 2015-16 regularly. Thus, this study was accomplished on yield performance and impact on soil properties through front line demonstrations (FLDs) of pigeonpea in Sitapur district, U.P.

The Table 1 is declared that the share of pigeonpea crop was 46.08, 41.04 and 49.61 per cent in total pulses production in India during the years 2017-18, 2018-19 and 2019-20. Pigeonpea crop is most prominent pulse crop to meet out the protein need our country in holistic manner.

Table 2 reflected the statistical values that district Sitapur contribute 35.56 % in total production of pigeonpea in U.P. and the average productivity is much higher than state and national level. Considering these essential facts and requirements of pigeonpea production here study was finished with solitary objective to analyze yield performance of pigeonpea through front line demonstrations in Sitapur district of U.P.

Methodology

Forty eight front line demonstrations (FLDs) on pigeonpea were conducted at farmers' field to assess pigeonpea production performance during Kharif season. The FLDs were conducted on three pigeonpea locations covering whole district i.e. Biswan, Alia and Laharpur blocks. An extensive survey and group discussion was made before conducting the front line demonstrations to find out the need based and suitable farmers. The suitable innovative farmers were selected through group meeting in each respective year. The demonstrations carried out on improved varieties of pigeonpea NA-1, recommended dose of seed 15 kg ha^{-1}, ridge sowing (60 × 15 cm) by seed drill. Seed treatment was done with Carbendazim @ 3 g kg^{-1} seed) and again treatment with Rhizobium and phosphorus solubilizing bacteria (PSB) cultures @ 5 g kg^{-1} seeds and soil test value based fertilizer application was made. The usual visits by respective scientists to FLDs plots were also done to make sure timely application of important inputs and crop management guidance as well. The relevant extension activities like field days at the demonstration site were organized regularly to keep farmers motivated and aware of demonstrated technology and its performance in the farmer's fields. The yield data were collected from all demonstration units including with the farmers feedback as such for further improvement and their opinions on future adoption of this technology. In order to estimate the technology gap, extension gap and technology index the following formula was used as per described by *Samui et al. 2000.*

$$\text{Extension gap} = \text{Demonstration yield-Farmer's yield}$$

$$\text{Technology gap} = \text{Potential yield} - \text{Demonstration yield}$$

$$\text{Technology index} = \frac{(\text{Potential yield} - \text{Demonstration yield})}{\text{Potential yield}} \times 100$$

Results and Discussion

Explanation of Yield Gap, Extension Gap and Technology Index

Yield of FLD trials and potential yields of respective varieties of pigeonpea was compared to guesstimate the yield gap, which was supplementary categorized into technology and extension gaps. The technologies adopted by farmer during FLDs were studied through technology index, which shows the possibility of the evolved varieties at the farmer's field. The lower value of the technology index expressed the feasibility of the demonstrated varieties. Thus, lower value of the technology index represents the more suitability of the varieties at the farmer's field condition.

Technology gap analysis

Pigeonpea variety NA-1 was demonstrated at 15.65 ha area of farmer's field in six villages of the Sitapur in year 2012-13, 2013-14 & 2014-15. The average yield of demonstrated varieties at farmer's field was 2.24 t ha^{-1} as compared to 1.53 t ha^{-1} with controlled plots or farmers practices (Table 3). The results revealed that the technology gap was recorded 0.72 to 0.79 t ha^{-1}, It means the pigeonpea variety NA-1 can yield even more productivity if grown with recommended technological intervention and an average technology gap under

Table 1: Production statistics of major pulse crops in India.

Pulses/Year	2017-18 (M. Tones)	Share in total production (%)	2018-19 (M. Tones)	Share in total production (%)	2019-20 (M. Tones)	Share in total production (%)
Pigeonpea	4.29	46.08	3.32	41.04	3.83	49.61
Chickpea	11.38	122.23	9.94	122.87	11.35	147.02
Urdbean	3.49	37.49	3.06	37.82	2.04	26.42
Moongbean	2.02	21.70	2.46	30.41	2.46	31.87
Lentil	1.62	17.40	1.23	15.20	1.18	15.28
Other Kharif pulses	0.83	08.92	0.63	07.79	0.81	10.49
Other Rabi pulses	1.78	19.12	1.45	17.92	1.50	19.43
Total pulses	9.31	-	8.09	-	7.72	-

Source: Directorate of Economics and Statistics (DES): Based on 1st Advance Estimates for 2020-21

Table 2: Area, production and productivity of pigeonpea in U.P. and Sitapur.

Year	Production statistics of pigeonpea						
	Area		Production		% share in total production of state	Productivity (kg ha-1)	
	*U.P. (M ha)	**Sitapur (M ha)	U.P. (M tones)	Sitapur (M tones)		U.P.	Sitapur
2012-13	0.31	0.1134	0.33	0.1065	32.27	1045	939
2013-14	0.30	0.0865	0.27	0.0835	30.93	900	965
2014-15	0.29	0.0856	0.17	0.0739	43.47	606	863
Average	0.30	0.10	0.26	0.09	35.56	850.33	922.33

***Source*:** *Agricultural statistics at glance, 2014 and 2016,

**http://updes.up.nic.in/spiderreports/gettable20Report.action

Table 3. Yield performance of demonstrated pigeonpea varieties on farmer's field during (2012-13 to 2014-15).

Years	Yield Potential (t ha^{-1})	Yield in FLD plots (t ha^{-1})	Yield in control plots (F.P.) (t ha^{-1})	Yield increase (%)	Extension gap (t ha^{-1})	Technology gap (t ha^{-1})	Technology index (%)
2012-13	3.0	2.21	1.52	45.39	0.69	0.79	26.33
2013-14	3.0	2.23	1.53	45.75	0.70	0.77	25.67
2014-15	3.0	2.28	1.55	47.10	0.73	0.72	24.00
Average	3.0	2.24	1.53	46.08	0.71	0.76	25.33

3 years FLDs programme on pigeonpea cultivation was observed 0.76 t ha^{-1}. The technology gap observed under study may be due to variation in fertility status of the soils, integrated crop management and local weather condition effect on pigeonpea crop *(Kumar et al., 2010)*.

Extension gap analysis

The extension gap analysis values were varies from 0.69 to 0.73 t ha^{-1} with pigeonpea variety NA-1 during 2012-13, 2013-14 and 2014-15 (Table-3) with respective ranks this result again reveals that if we give more emphasis on technical extension services that may enhance the yield of pigeonpea varieties in loam soil condition of Sitapur district and an Average extension gap was observed 0.71 t ha^{-1}, which emphasized the extension need to make farmers aware and educate the farmers with high yielding varieties, suitable varieties recommendation according to soil type and fertility status of soil, integrated crop and weather management in kharif season through various extension activities like FLDs, trainings, sangosthies, field visits, diagnostic visits, group discussion for adoption of improved pigeonpea cultivation technologies to minimize the extension gap which resulting to improve productivity of pigeonpea pulse crop.

Technology index analysis

Although it is again clearly evident from the results that minimum technology index was recorded 24.00% during 2014-15 followed by 2013-14 and 2012-13 given in Table 3. The technology index showed the viability of the evolved technology at the farmers' fields. The lower the value of technology index reveals the more is viability of technology. The difference in the yield among the varieties is possible due to variation in soil fertility, irrigation facility, non-congenial weather and location specific management problems as described by Singh et al., 2017.

However, the results clearly showed increase in pigeonpea yield up to 46.08 per cent over control or farmers practice. The technology index was lowest 24.00%, which indicates that variety NA-1 is performing best at the farmer's field. The technology index of demonstrated variety ranges between 24.00 to 26.33 per cent (average-25.33 per cent) indicating the high level of adoption and good performance of technical interventions at farmer's field conditions. Yield enhancement in different crops in FLDs has been documented by Roy Burman et al., 2010, Kumar and Sharma, 2013, *Singh et al., 2016* and *Singh et al., 2017* are in line and supporting to the finding observed under this study.

Conclusion

The front line demonstrations conducted on pigeonpea production was found effective in changing mind set of farmers, improved knowledge on recommended practices of pigeonpea cultivation for enhancing productivity. This also improved the rapport building and interface between farmers and scientists. The study revealed that the yield of pigeonpea could be increased by 46.08 per cent an average in Sitapur district though font line demonstrations. The technology gaps were in ranged between 0.72 to 0.79 t ha^{-1} and 0.76 t ha^{-1} an average of three years observations possible due to dissimilarity in fertility status of the soils, integrated crop management and local weather condition effect on pigeonpea crop. The extension gap ranged between 0.69 to 0.73 t ha^{-1} and 0.71 t ha^{-1} an average, which needs various extension activities like FLDs, trainings, sangosthies, field visits, diagnostic visits, group discussion for adoption of improved pigeonpea cultivation technologies to minimize the extension gap which resulting to improve productivity of pigeonpea pulse crop. The technology index of all three demonstrated varieties ranges between 24.00 to 26.33 per cent (average-25.33 per cent) indicating the high level of adoption and good performance of technical interventions at farmer's field conditions. The technology index was lowest during 2014-15, which indicates that variety NA-1 is performing best at the farmer's fields of Sitapur district.

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