Original Research Article

Performance of Pigeonpea Varieties (*Cajanus Cajan* L.) Through Sowing Raised Bed Planting System under Front Line Demonstration at Farmer's Field in Deoria District of Uttar Pradesh, India.

ABSTRACT

Aims: The production of pigeon pea is lower than the other pulse crops due to non-adoption of recommended high-yielding varieties and advanced technologies by the farming community in the eastern plains of Uttar Pradesh. To replace this anomalous, we conducted 152 front-line demonstrations (FLDs) at farmers' fields in various adopted villages by Krishi Vigyan Kendra, Deoria.

Study design: Not Aplicable

Place and Duration of Study: The study was carried out by the KrishiVigyan Kendra, Malhana, Deoria, under the Indian Institute of Vegetable Research, Varanasi, UP. A total of 90, 12 and 50 FLDs were conducted under raised bed sowing with three varieties of pigeon pea (Narendra Arhar 1, Pusa Bahar and Narendra Arhar 2) from 2014-15 to 2018-19 respectively.

Methodology: Conducted 152 front-line demonstrations (FLDs) at farmers' fields in various adopted villages by Krishi Vigyan Kendra, Deoria. Cultivation practices comprised under FLD viz. improved varieties, sowing methods, irrigation, date of sowing, seed treatment, spacing, balance use of fertilizers, intercultural operations, and plant protection measures etc.

Results: Showed an increase in yield of pigeon pea varieties under raised bed planting from 4.76–39.20% over traditional cultivation practices. As presented in Table 4, the technology gap was highest in Narendra Arhar 1 (1680 kg/ha) during 2016-17 and lowest in Narendra Arhar 2 (340 kg/ha) during 2018-19. The analysis of data for extension gap showed that Narendra Arhar 2 had the highest gap (540 kg/ha) during 2017-18 and Narendra Arhar 1 had the lowest gap (60

kg/ha) during 2016-17. The technology index was highest (56 %) in Narendra Arhar 1 in 2016-17 and lowest (15 %) in Narendra Arhar 2 in 2018-19.

Conclusion: The lower the value of the technology index, the more feasible the technology is in the eastern plains of UP.

Key Word : (Raised bed sowing, Front line Demonstration, High-yielding varieties, Technology Index, Pigeonpea)

1. INTRODUCTION

Pulses are an essential part of the Indian diet since they are a significant source of protein and can be cultivated in a variety of agro-climatic regions across the nation. Pigeon pea (Cajanus cajan L.) output and area are second only to chickpea among pulses. Pigeonpea (Arhar), commonly known as Redgram or Tur, is a very old crop in this country. It serves a variety of purposes and plays a significant role in both the country's current farming practices and the vegetarian diet. The frequency of pulse consumption in India is far greater than that of any other source of protein, which indicates the importance of pulses in their daily food practice. With the aforementioned information in mind, it is critical to boosting the production of pulses in order to provide a balanced diet to the nation's citizens as part of the district's malnutrition program. It also plays a significant role in the sustainable agriculture farming system by enriching the soil through biological nitrogen fixation along with the deep root system of this crop, which makes it more suitable for its cultivation under rain-fed conditions. India occupied 4.53 million hectares of land, produced 3.89 million tones with an average productivity of 859 kg/ha, and Uttar Pradesh occupied 0.29 million hectares of land, produced 0.28 million tones with an average productivity of 980 kg ha-1 under irrigated conditions (Agricultural Statistics at a Glance 2021). Defective cultivation practices, such as sowing methods, improper crop geometry, avoidance of weedicide use, bio-fertilizer operations, and climatic variability, are major reasons for limiting pigeon pea potential yield. The Frontline demonstrations (152) were conducted on farmers' fields to demonstrate the impact of improved technology (Raised bed bed planting method) varieties and other management technology on pigeon pea productivity over three years during Kharif 2014-15 to 2018-19.

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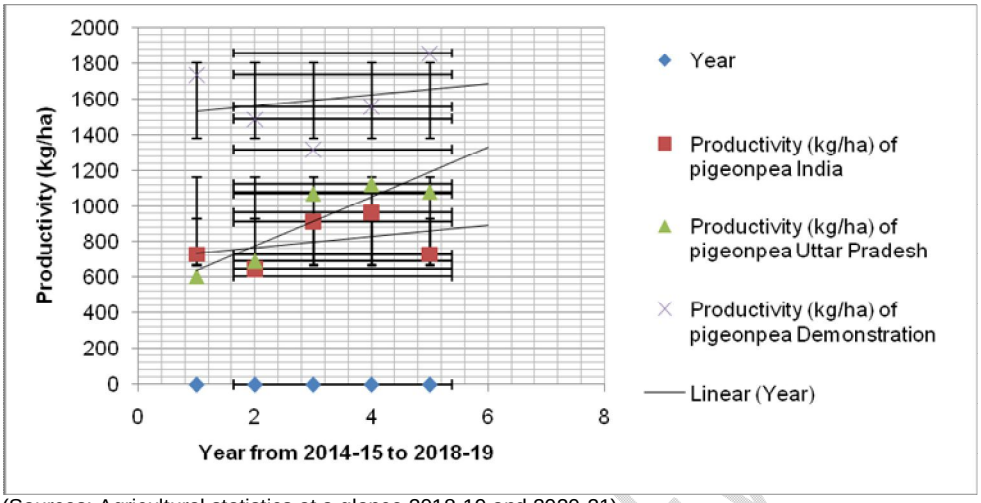
Comment [jv2]: The phrase **in order to** may be wordy. Consider changing the wording.

Comment [jv3]: The phrase **in order to** may be wordy. Consider changing the wording.

Comment [jv4]: The indefinite article, **an**, may be redundant when used with the uncountable noun **productivity** in your sentence. Consider removing it.

Comment [jv5]: It appears that you typed **bed** twice in a row. Consider deleting one of them.



(Sources: Agricultural statistics at a glance 2018-19 and 2020-21)

Fig.1: Shows the productivity of pigeon pea (Kg/ha) in India, Uttar Pradesh, and demonstrated fields.

2. MATERIALS AND METHOD

The performance of high-yielding pigeon pea varieties, NA 1 (Narendra arhar 1), NA 2 (Narendra arhar 2), and Bahar, sowing through the raised bed planting system versus the traditional planting method, was evaluated in the current study through front line demonstrations (FLDs) at farmer's fields during Kharif seasons 2014–15 and 2018–19. The study was carried out by the KrishiVigyan Kendra, Malhana, Deoria, under the Indian Institute of Vegetable Research, Varanasi, UP. A total of 90, 12 and 50 FLDs were conducted under raised bed sowing with three varieties of pigeon pea (Narendra Arhar 1, Pusa Bahar and Narendra Arhar 2) from 2014-15 to 2018-19 respectively. Agronomical practices used for the present study ~~with respect to~~ FLDs and farmer's practices are given in Table 1. The crop was sown in the last week of June and harvested in the first week of April. The raised bed sowing of pigeon pea was compared with the traditional method (broad casting) used by the farming community of Deoria District. The study area's soils are very deep, loam to silt loam in texture, and moderately to well drained with ground water irrigation. Soils are medium in fertility status. The climate of the district is characterized by a dry summer and a cool winter with high rainfall during the Kharif season. The FLDs were conducted to find out the gaps between the potential yield and the average yield of demonstrations. The extension gap and technology index ~~were~~ calculated as per standard methods. For evaluation of the performance of different varieties, the yield data ~~was~~ recorded and compared with traditional practices and local varieties grown by the farmers. Critical inputs in the form of quality seeds of recommended high-yielding varieties for FLDs were provided to the farmers. The farmers were facilitated by KVK subject matter specialists in performing field operations like sowing, thinning, irrigation, fertilizer application, weedicide spraying, harvesting, threshing, and storage, etc. during the study period, course of training, visits, and field days.

Comment [jv6]: The phrase **with respect to** may be wordy. Consider changing the wording.

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The demonstrated technologies in the fields are presented in table 1 and compared with local practices. The technology gap, extension gap, and technological index (Samui et al., 2000) were calculated by using the following formula as given below.

Technology gap (A) = Pi-Di (Potential yield - Demonstration Yield)

Extension gap (B) = = Di-Fi (Demonstration yield –Farmers Yield)

Technology index (C) = $\frac{Pi-Di}{Pi} X\ 100$

Where

Pi= Potential Yield
Di= Demonstration Yield of the Crops.
Fi= Farmers Yield

Table 1: Agronomical practices used for pigeon pea growing under FLDs and farmer practice

Practice	Demonstrations practice	Farmers Practice
Farming situation	Irrigated and sandy loam	Irrigated and Sandy loam
Varieties	NA 1, NA 2 and Bahar	NA 1, NA 2 and Bahar
Date of sowing	15 June to 25 July	15 June to 25 July
Method of sowing	Raised bed planting method	Broadcasting method
Seed Rate (kg/ha)	10-12	15-18
Irrigation (No.)	Once	Once
Fertilizers (kg/ha)	(N:P:K) 30: 60 :40	(N:P:K) 30: 60 :40
Weeding	At 35 DAS	At 35 DAS
Date of harvesting	01-15 April	01-15April

3. RESULTS AND DISCUSSIONS

3.1 Interpretations of grain yield

Raised bed sowing of pigeon pea was evaluated against broad casting (traditional method) through front line demonstration on selected farmer's fields in Deoria district during Kharif 2014–15 to 2018–19. The average yield of raised bed planting of pigeon pea variety NA 1 under FLDs was recorded at 1740 kg/ha and 1320 kg/ha in the years 2014–15 and 2015–16, which was 39.20% and 4.76% higher than the ~~broad~~ casting method. Similar findings were noted in pigeonpea by Tiwari et al., (2017). The yield gap analysis has been carried out by several workers (Mitra et al., 2010, Meena et al., 2010) in different parts of the

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country and reported the superiority over local or traditional technologies. Yield enhancement through frontline demonstration in Indian mustard has also been reported by Tiwari et al., (2017); Meena et al., (2018); Hiremath et al., (2007); Dhaka et al., (2010); and Kumar et al., (2010). The average yield of Pusa Bahar under FLDs was noted at 1490 kg/ha in the year 2015-16. The Pusa bahar variety of pigeon pea gave a 35.20% higher yield than the broad casting method. Presented data in Table 2, the average yield of the NA2 variety of pigeon pea under front line demonstration was found at 1560 kg/ha and 1860 kg/ha in the years of 2017-18 to 2018-19. This variety gave a 52.94% and 30.98% higher yield under the raised bed planting method than the traditional method during the demonstration period of the farmer's field in Deoria district, Eastern Uttar Pradesh. However, productivity remains lower than potential yield, necessitating additional research in this area. Better performance and on-farm demonstration of local methods are enough to entice the farming community to grow pigeon pea crop. Further analysis of data showed that the yield of pigeon pea varieties (NA 1, Pusa Bahar and NA 2) increased successively, which clearly speaks of the positive impact of raised bed panting under FLDs over the traditional method of pigeon pea planting (Table 2) in this region. The results indicated that the FLDs have had a good impact on the farmers' community of Deoria District, as motivated by the recently introduced improved technologies in the farmer's fields.

Table 2: Variety, number of FLDs, area and yield of pigeon pea grown under FLD and existing practices

Year	Variety	Number of demonstration	Area (ha)	Yield (Kg/ha)		% Increase
				Demonstration	Traditional	
2014-15	NA1	26	7.8	1749	1250	39.20
2015-16	Pusa Bahar	12	3.7	1490	1102	35.20
2016-17	NA1	64	24	1320	1260	04.76
2017-18	NA2	25	10	1560	1020	52.94
2018-19	NA2	25	10	1860	1420	30.98

3.2 Interpretations of extension gap, technology gap and technological index

3.2.1 Extension gap

The presented data in Table 4 the extension gap ranging from 60 to 540 kg/ha during the study period emphasizes the need to educate the farmers through various means for the adoption of improved technologies to reverse this trend of wide extension gap. Meena *et al.* (2010) reported an extension gap in mustard from 3.36 to 4.64 q/ha in the south-eastern part of Rajasthan. Similar extension gaps in frontline demonstration of pigeonpea have also been documented by Tiwari *et al.*, (2017). This

concerning trend of hurdle extension gap will subsequently change as more and more advanced production technologies with high-yielding varieties are used. The above findings are similar to the findings of Samui *et al*. (2000).

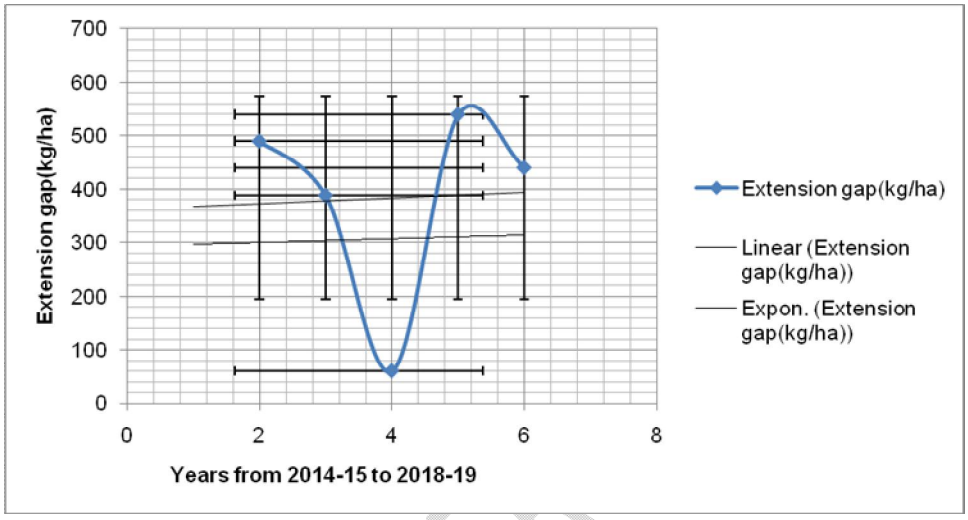

Fig.2: Shows the extension gap of pigeon pea varieties during study period.

3.2.2 Technology gap

The technology gap (ranging between 510 and 1680 kg/ha) reflected the farmer's cooperation in carrying out such a demonstration, with encouraging results in ~~subsequent~~ improved technologies. The technology gap observed may be attributed to the dissimilarity in the soil fertility status and weather conditions. This concerning trend of a galloping extension gap will eventually change. The new technologies will eventually lead the farmers to terminate the old method with the new technologies.

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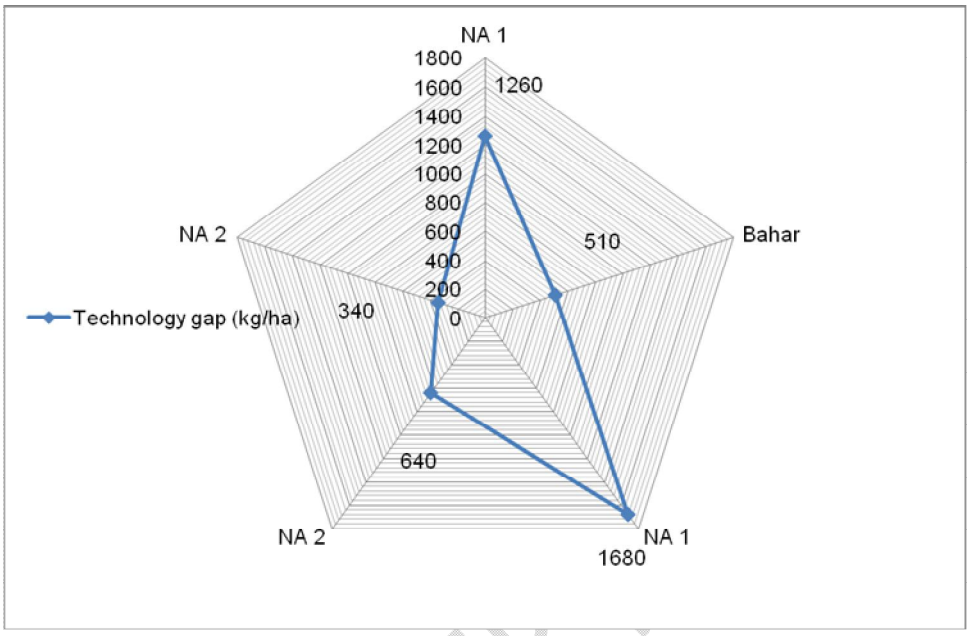

Fig.3: Shows the extension gap of pigeon pea varieties during study period.

3.2.3 Technological index

The technological index showed the feasibility of the evolved technology in the farmer's field. The lower the value of the technology index, the greater the feasibility of the technology (Sagar and Chandra 2004). The benefit-cost ratio of front line demonstration (Table 3) clearly revealed that the benefit with B:C ratio from demonstrated practice was substantially higher than control plots, i.e., the traditional method of four years of demonstration.

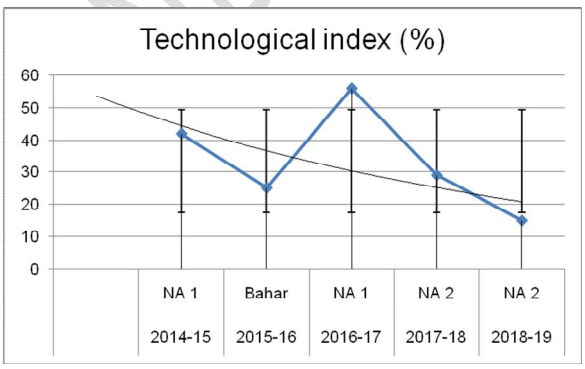

Fig.4: Shows the technology index of pigeon pea grown under FLDs.

4. Economic analysis

Presented in Table 3, economic analysis of the demonstrated technology showed an increased net profit of 9 to 75% over the traditional method during the five-year demonstrated period. Similar results were reported by Singh et al. (2014) in Chickpea.

Table 3: Average gross return, net profit and B: C ratio of pigeon pea grown under FLDs and traditional varieties

Year	Variety	Economic of Demonstration Technology (Rs)				Economic of Farmers Practice (Rs)			
		Gross Cost	Gross Return	Net Return	B:C	Gross Cost	Gross Return	Net Return	B:C
2014-15	NA 1	20370	59160	38790	2.9:1	20116	42500	22384	2.1:1
2015-16	Pusa Bahar	22380	77480	55100	3.4:1	23420	57304	33884	2.4:1
2016-17	NA 1	25320	58080	32760	2.2:1	25440	55440	30020	2.1:1
2017-18	NA 2	27220	85800	58580	3.1:1	26830	60224	33394	2.2:1
2018-19	NA 2	28225	102300	74075	3.6:1	28840	78100	49260	2.7:1

The net profit was 75% more in the year of 0217-18 under raised bed sowing of pigeon pea. The data indicated a benefit cost ratio of 2.9:1, 3.4:1, 2.2:1, 3.1:1, 3.6:1 and 2.1:1, 2.4:1, 2.1:1, 2.2:1, 2.7:1 under raised bed planting and the traditional method of pigeonpea sowing. Similar findings were reported by Balai *et al.* (2012) in mustard and Sharma (2003) in moth bean. The Narendra Arhar 2 variety of pigeonpea was found to be economically most beneficial in a raised bed planting system compared to the traditional method in the eastern uplands of Utter Pradesh. Progressive and economically rich farmers should opt for a raised bed planting system with the Narendra Arhar 2 variety of pigeonpea. The favorable benefit-cost ratio proved the economic viability of the intervention made under demonstration and convinced the farmers of the utility of the intervention.

4. CONCLUSION

The showcasing of proven technologies through FLDs increased the yield potential of pigeon pea to a great extent in the hot sub-humid (moist) ecoregion of Utter Pradesh. The results of the front-line demonstration demonstrated that with improved crop production techniques and better management,

pigeon pea yield could be increased by 4.76-39.20%. From the above findings, it can also be concluded that the use of scientific methods in pigeon pea cultivation reduced the technological gap and extension gap to a considerable extent. This will substantially increase the income as well as the livelihood of the farming community. There is a need to adopt a multi-pronged strategy that involves enhancing pigeon pea production through improved technologies in the eastern plains of UP. This should be brought to the access of farmers through the transfer of technology centers like KVKs and line departments.

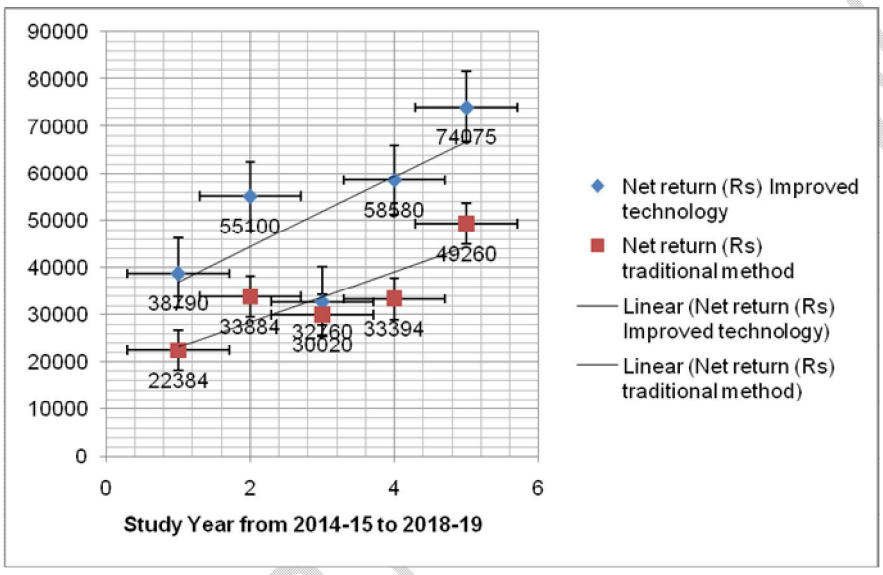

Fig.5: Shows the net return of demonstration and traditional technology during study period

REFERENCES

Agricultural Statistics at a Glance. Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Directorate of Economics & Statistics, P.72-74, 2020-21.

Balai CM, Meena RP, Meena BL and Bairwa RK. Impact of front line demonstration on rapeseed-mustard yield improvement. Indian Research Journal of Extension Education. 2012; 12(2):113-116.

Bhati BS, Ramawtar, Soni RL, and Bugalia HL. Impact of Front Line Demonstration on Yield and Profitablitiy of Chickpea (*Cicer arietinum Linn*) in Banswara district of Rajasthan. Indian Journal of Extension Education. 2018; 54 (3):150-153.

Dhaka BL, Meena BS and Suwalka RL. Popularization of Improved Maize production technology through frontline demonstrations in southeastern Rajasthan. Journal of Agri. Sci. 2010; 1(1):39-42.

Hiremath SM, Nagaraju MV and Shashidhar KK. Impact of frontline demonstration on onion productivity in farmers field. Nation. Sem. Appropriate Extn. Strat. Manag. Rural Resources, Univ. agric. Sci. Dharward. 2007; *December,* 18-20:100.

Kumar A, Kumar R, Yadav VPS and Kumar R. Impact Assessment of Frontline Demonstrations of Bajara in Haryana State. Indian Research Journal of Extension Education. 2010; 10(1):105-108.

Meena BL, Meena RP, Meena RH and Balai CM. Yield gap analysis of rapeseed-mustard through front line demonstrations in agro climatic zone IVa of Rajasthan. Journal of Oilseed Brassica. 2012; 3(1):51-55.

Meena BS, Meena DS, Meena KC and Meena CB. Enhanced Mustard Productivity and Profitability through Frontline Demonstrations in South-Eastern Rajasthan. International Journal of Current Microbiol. App. Sci. 20187; (7):800-805.

Mitra B and Samajdar T. Yield gap analysis of rapeseed and mustard through frontline demonstrations. Agril. Ext. Review. 2010; 22(2):16-17.

Sagar RL and Chandra G. Frontline Demonstrations on Sesame in West Bengal. Agric. Ext. Review. 2004; 16(2):7-10.

Samui SK, Mitra S, Roy DK, Mandal AK and Saha D. Evaluation of front line demonstration on groundnut. Journal of the Indian Society Costal Agricultural Research. 2000; 18(2):180-183.

Sharma OP. Mothbean yield improvement through frontline demonstrations. Agril. Ext. Review. 2003; 15(5):11-13.

Singh D, Patel K, Baghel SK, Singh MS, Singh A and Singh AK. Impact of front line Demonstration on the Yield and Economics of Chickpea (Cicer arietinum L.) in Sidhi District of Madhya Pradesh. Journals of Agri Research. 2014; 1(1):22-25.

Tiwari D, Kumar A, Chandra S, and Sahay R. Performance of Bahar and Narendra Arhar Pigeon pea (Cajanus cajan) under Front Line Demonstrations in Unnao district of Uttar Pradesh. Bull. Env. Pharmacol. Life Sci. (2017); Vol 6 Special issue (5): 249-252.