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FIELD-LEVEL ADAPTATION OF PROMISING PIGEON PEA CULTIVARS AT RANGPUR REGION BASED ON FARMERS' REACTION

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ABSTRACT

Sarker MB, Hossain J, Rahman MME, Saha AK, Rahman MW (2023) Field-level adaptation of promising pigeon pea cultivars at Rangpur region based on farmers' reaction. *Int. J. Sustain. Crop Prod.* 18(2), 17-21.

This research was conducted on high yielding suitable lines of pigeon pea and importance of adaptation at farmer's level. This study was established in the field of Regional Agricultural Research Station, BARI, Burirhat, Rangpur, BARI in June 2020. Five pigeon pea lines were studied. Pea *viz.* BD-3121, BD-3124, BD-3135 and Naogaon local lines are used. The experiment was laid out in a Randomized Complete Block Design with three dispersed replications. Among the lines, Naogaon local line has the highest yield of 1.7 kg/plant and 3.4 tons/hectare. Besides, it is preferred by 80-90% of the farmers as the plant has dwarf early maturity and synchronized maturity characteristics.

Key words: *adaptation, promising, pigeon pea, farmer's reaction*

INTRODUCTION

Pigeon pea (*Cajanus cajan* (L.) Millsp.) is one of the protein-rich legumes of the semi-arid tropics grown throughout the tropical and subtropical regions of the world. Pigeon pea is a tropical grain legume and is among the important pulses grown for food, feed, and soil fertility improvement. The kernels are nutritionally rich containing 20-22% protein. Its cultivation would be able to provide 40-60 kg N/ha to the subsequently grown crop. The leaves and immature stems can be used as green manure. Pigeon pea offers great potential as an economic crop in the economy of some nations, and it constitutes their major cash crop, especially in India and Malawi (Gwata *et al.* 2006). It does not only serve as protein for both humans and livestock but also is very useful in the pharmaceutical industry as medicine (Egbe 2005). Additionally, it is useful in food processing due to its ability to be processed into many forms, such as biscuits, noodles, cookies, flour, and bread, among others (Gwata and Silim, 2009), thus making it highly relevant economically. It is highly attractive to smallholder farmers of rural areas in many developing countries such as Nigeria (Kaoneka *et al.* 2016). This is because pigeon pea can be a source of income for men and women and functions as feed for livestock, fencing material for rural dwellers, and uniquely serve as food during the lean period with little or no value addition (Ayenan *et al.* 2017).

It is a crop of rain-fed agriculture due to its deep taproot system (Mallikarjuna *et al.* 2011). It is fast-growing, hardy, widely adaptable and drought-resistant (Bekele-Tessema 2007). Being environmentally friendly by fixing nitrogen, and flexibility for mixed cropping or intercrop, due to it has a significant position in dryland farming systems especially adopted by small and marginal farmers in many parts of the world (Pandit *et al.* 2015). Its deep taproot can extract nutrients (like P) from the deep root zone of soil and is available in upper layers where they can benefit other crops (Valenzuela 2011). As a drought-resistant crop, it can be considered of utmost importance for food security in regions where rain failures are prone to occur (Crop Trust 2014). Fallen leaves can also be used as mulch and thus help to enhance the water-holding capacity of the soil (Sarker *et al.* 2018). The seed contains 18–29% protein on a dry weight basis, which is about three times the value found in cereals, and is closer to soybean, which is 34% (Reddy *et al.* 1979). The protein is also of excellent quality, being high in lysine. It is used as a contour hedge in erosion control. The crop is, therefore, an important complement to cereal and root-based diets (Varshney *et al.* 2009). Moreover, Tista floodplain (AEZ-3**)** Bangladesh is mainly occupied by the recent alluvial and floodplain sediments. Tista floodplain covers most of Rangpur and adjoining regions that lie in the younger part of the Tista alluvial fan that covers several different landscapes. Monsoon climate dominates this region where rainfall is abundant. The average annual rainfall in this region is a little over 1,900 mm. The soil climate of this region has ample potential for cultivation of this pulse crop in fields, roadsides and crop field borders. However, the total production of pigeon pea is only about 520 metric tons under 500 hectares of land in Bangladesh (AIS 2019). It can be grown not only on the mainland but also on border, roadside and fallow land with less management and minimum cost. There is a great opportunity to establish this pulse crop easily increasing farmers' income and production. But lack of suitable variety and farmer's knowledge how to cultivate this crop. So, this experiment has been undertaken to find suitable lines of pigeon pea for higher yield.

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MATERIALS AND METHODS

Location

The experiment was conducted at the Regional Agricultural Research Station of BARI, Burirhat during the Kharif season of 2020.

Treatments and design

The experiment was laid out in a Randomized Complete Block Design with three replications. The experiment was studied with five pigeon pea lines *viz*., BD-3121, BD-3124, BD-3135, Naogaon local.

A. Sample plant B. Leaf, Flower and pod C .Harvested mature pod D. Seed

Fig. 1. Pigeon pea plant samples like leaf, flower, pod & seed

The Pigeon Pea plant shown in Figure A is usually up to 3-4 m tall, the leaves shown in B are green, the flowers are racemes, yellow in color, the pods are mostly cylindrical and the seeds are small yellow in color.

Soil condition of the experiment site

The soil of the experimental site was silty loam in texture and belongs to the Tisa Meander Floodplain (UNDP and FAO, 1988) under the Agro-ecological Zone-3. The selected site was a medium-high land and the soil pH was 5.7, which was slightly acidic. The analytical data of the soil sample from the experimental area was determined in the Soil Testing Laboratory, Soil Resource Development Institute, Dinajpur, which is presented in (Table 1).

Table 1. Soil analysis data in the research field

A. Mechanical analysis		B. Chemical analysis	
Constituents	**Percent**	**Soil properties**	**Results**
Sand	35	pH	5.7
Silt	35	Organic carbon	1.26
Clay	30	Total nitrogen	0.074
Textural classification	Silty loam	Phosphorus	15.38ppm
		Potassium	0182 me%
		Zinc	0.55ppm
		Boron	0.285ppm

Experimental procedures

Unit plot size was 4 m x 6m and seeds were sown in rows with spacing 1 m. The seeds were sown on 18 Jun 2020. In the experimental plots fertilized with @18-24-30-18-2.0-1 kg ha^{-1} N-P-K-S-Zn and B during final land preparation (Fertilizer Recommendation Guide-2012). Fungicide, insecticide application and other intercultural operations were done when necessary. Three plants were selected randomly from the middle rows of each entry for data collection. Qualitative data were taken as per the descriptor description of IBPGR and ICRISAT, 1993. Based on the qualitative characteristics the opinion of the farmer is taken as a percentage which is based on the opinion of 30 farmers.

Statistical analysis

Data were analyzed statistically. The analysis of variance (ANOVA) used Statistic 10 software. The mean separation test was done through DMRT

Climate of the experimental site

The experimental area was situated in the sub-tropical climatic zone, Information regarding monthly temperature, relative humidity and rainfall data recorded during the period of the present study were collected from the weather station at Rangpur (Table 2).

Table 2. Records of meteorological observation (weekly) during the period of the experiment from January 2020 to December 2020

Month	Average Temperature(^{0})		Total Rainfall (Average mm)	Humidity (%) (Average)
	Max	Min		
January	22.50	13.7	18.3	77.26
February	26.08	15.1	3.3	70.59
March	30.09	18.8	22.6	68.45
April	31.42	21.2	246.3	70.82
May	31.45	23	651.2	81.83
June	28.37	25.3	665.7	74.32
July	24.20	25.8	968.5	82.50
August	22.50	26.5	430.2	84.50
September	26.08	25.7	827.3	87.00
October	30.09	25.2	392	78.23
November	28.37	16.41	0.3	68.72
December	24.20	12.62	0	74.97

RESULTS AND DISCUSSION

Significant differences were observed between the quantitative data *viz*., days to 50% flowering, duration of flower, days to maturity, plant height (cm), number of primary branches per plant, number of pods per branch, pod bearing length, number of seeds per pod, number of seeds per plant, 100-seed weight (g) and yield per plant (g of different lines of Pigeon Pea which is given in Table 3.

Table 3. Yield and yield contributing characteristics of pigeon pea lines at RARS, Burirhat, during 2020

Pigeon pea Lines	Days to first flowering	Days to 50% flowering	Days to 80% podding	Days to Maturity	Clusters/ raceme	Pods/ raceme	Seeds/ Branch
BD-3131	161b	166ab	181.6b	289.6b	4.6b	4c	177.6a
BD-3124	164.6a	168.6a	195.3a	320.67a	3.6b	4.333c	145.6b
BD-3121	160.3bc	165bc	175.6c	280.6c	8a	9b	91d
BD-3135	158c	162.6c	181b	291b	5b	8b	107.6c
Naogaon Local	148d	152.3d	167d	275c	8.6a	13.6a	190a
CV%	0.91	1	0.2	1.2	13.94	9.22	5.4
LSD $_{0.05\%}$	2.7068	3.0554	0.68	6.6	1.57	1.35	14.4

Significant differences in fast flowering were observed between different lines of pigeon pea. Early flowering was observed in the Naogaon Local line at 148 days on the other hand late first flowering in the BD-3124 line at 164 days (Table 3). In the case of 50% flowering, the Naogaon Local line was early at 152 days, on the other hand, the BD3124 line was late at 168 days. Significant differences were observed in pigeon pea lines for 80% podding. Comparably early podding was 167 days on Naogaon local lines but slightly late podding was 195 days on BD-3124 lines (Table 3). A significant difference in days to maturity was observed between pigeon pea lines. Days to maturity relatively early were 167 days in Naogaon local lines but slightly late maturity was 195 days in BD-3124 line (Table 3). Significant differences were observed among pigeon pea exhausting lines in terms of the number of clusters/raceme. Naogaon local line had the highest number of 8.6 clusters/racemes but comparatively fewer clusters/racemes were found in the BD-3124 line at 3.6 (Table 3). Significant differences were observed in pigeon pea lines in pod/raceme with a maximum 13.6 pods/raceme observed in Naogaon local lines whereas a minimum of 4 pods were observed in BD-3131line (Table 3). In terms of the Number of seeds/branches, a significant difference was observed in pigeon pea lines, the maximum seed/ branch was observed in 190 in the Naogaon local line and a similar result was found in BD 3131 line 177 but the minimum seed/branch was 91in BD-3121 lines.

In terms of plant height, significantly observed in pigeon pea lines, relatively dwarf plants were observed in the Naogaon Local line up to 3 m, but the tallest plant was found at 4.2 m in BD-3124 lines and similar results were found in BD-3135 line at 3.9 m (Table 4). Differences in raceme length can be seen in pigeon pea lines. Among the lines, a longer raceme of 6.1 cm was found in BD-3124 lines and a similar result was found in Naogaon local line 4, 5 cm. (Table 4). Variation in pod length was found in the pigeon pea line with long pods of 7.0 cm in the BD-3131 line and short pod length of 5.33 cm in the BD 3124 line (Table 4). Differences in yield/plant were observed in pigeon pea lines. Naogaon local line had the highest yield of 1.7 kg but the Bd-3131 line had the lowest yield of 1.1 kg/plant (Table 4). Differences in yield per hectare were observed in Pigeon Pea lines. The maximum yield of 3.4 tons was obtained in the Naogaon local line but the lowest yield of 2.1 tons/ha was

obtained in BD 3131 line (Table 4). Among five genotypes, Naogaon local showed the maximum 100-seed weight (17 g).

Table 4. Yield and yield contributing characteristics of pigeon pea germplasm at RARS, Burirhat, during 2020 (continued)

Pigeon pea lines	Plant height	Raceme length(cm)	Pod Length(cm)	Seed yield kg/plant	Yield (ton/h)	100 Grain weight(g)
BD-3131	3.26b	5.0ab	7.3a	1.1c	2.1d	17.1a
BD-3124	4.1a	6.16a	5.33c	1.2c	2.2d	13.02b
BD-3121	3.32b	4.46b	6.16bc	1.5b	2.58c	10.15c
BD-3135	3.9a	5.3ab	6.83ab	0.86d	3.16b	9.983c
Naogaon Local	3.03b	4.56b	6.4abc	1.7a	3.4a	9.59c
CV%	4.98	16.35	9.41	7.62	3.11	8.62
$LSD_{0.05\%}$	1.35	1.5	1.13	0.18	0.17	1.94

Differences in morphological characters were observed in Pigeon Pea lines which are presented in (Table 5). BD-3131 and BD-3124 lines are semi-spindling type and BD-3121 and BD-3135 lines are spiraling type but Naogaon local lines are erect complete type plants. In terms of flower colour, the flowers of BD-3131, BD3124, and BD-3135 lines showed light yellow flowers, but the BD-3121 line had purple flowers and Naogaon local lines had yellow-orange flowers. Pigeon Pea lines have green-coloured pods on BD-3131 and BD-3124 lines and pods of BD-3121 and BD-3135 lines are of mixed green and purple colour on the other hand the pods of Naogaon local line are purple.

Table 5. Different morphological characteristics of pigeon pea lines

Pigeon pea lines	Plant type	Flower color	Pod Color	Flowering Pattern	Pod size	Maturity type	Seed color
BD-3131	Semi spreading	Light yellow	Green	Indeterminate	Large & flat	Desynchronized	Light brown
BD-3124	Semi spreading	Light yellow	Green	Indeterminate	Cylindrical& large	Desynchronized	Light brown
BD-3121	Spreading	Purple	Mixed green & purple	Indeterminate	Cylindrical& small	Desynchronized	Light brown
BD-3135	Spreading	Light yellow	Mixed green & purple	Semi-determinate	Cylindrical& medium	Desynchronized	Brown
Naogaon Local	Erect and compact	Yellow-orange	purple	determinate	Cylindrical& medium	Synchronized	Reddish brown

In pigeon Pea lines, indeterminate type flower type characteristics were observed in lines BD- 3131, BD- 3124 and BD- 3121 but semi- determinate type flower type characteristics were observed in line BD- 3135 on the other hand determinate type flower characteristics were observed in Naogaon local line. Variation in pod size was observed in the Pigeon Pea line, cylindrical and medium type pods were observed in line BD-3135 and Naogaon local, cylindrical small type pods were observed in BD-3121 lines, cylindrical large type pods were observed in BD- 3124 line and large flat type pods were observed in BD- 3131 line. Desynchronized maturity was observed in all pigeon pea lines except only Naogaon local line where synchronized maturity was found in Naogaon local line. The Pigeon Pea line had light brown seed colour in BD-3131, BD-3124 and BD-3121 lines and brown color seeds were found in the BD-3135 line but reddish brown colour seeds were found in line Naogaon local.

Farmers opinion and preference percentage based on different characteristics of Pigeon Pea line are mentioned in Table 5. In terms of its synchronized maturity, Naogaon local line is preferred by 90% farmers because of the fact that the seeds of this line mature at the same time due to which it can be harvested at the same time. Considering height and canopy, 80% of farmer's preferred Naogaon local line and the BD 3135 line was preferred by 20% of farmers because of the higher canopy. In terms of seed colour and size, 70% of farmers' preferred Naogaon local line, while 20% of farmers preferred BD 3135 line and 10% of farmers preferred BD 3121 line. In terms of yield, Naogaon local line is preferred by 80% of farmers, on the other hand, BD 3135 and BD 3121 lines are preferred by 10% of farmers. Naogaon local line is preferred by 80% of farmers considering the taste of green (raw) and dal conditions, on the other hand, BD 3135 and BD 3121 lines are preferred by 10% of farmers. By all characteristics, farmers choose Naogaon local line as pigeon pea.

Table 6. Different characteristics of pigeon pea lines based on farmer's reactions

Pigeon pea Lines	Synchronization	Canopy height of plant	Seed color & size	Seed yield	Test (Green & Mature)	Farmer's reaction
BD-3131	-	-	-	-	-	Did not like
BD-3124	-	-	-	-	-	Did not like
BD-3121	-	-	10%	10%	10%	-
BD-3135	10%	20%	20%	10%	10%	Preferred as the seed matures little by little
Naogaon Local	90%	80%	70%	80%	80%	All in all a favorite

CONCLUSION

The results exhibited that out of five the pigeon pea accessions, Naogaon local, were found higher yield and it may be considered a better line. These lines may be used in pigeon pea variety improvement programs.

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