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Assessment of promising varities of pigeon pea for production potentially under Northern dry zone of Karnataka

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Abstract
Demonstrations on assessment of promising varities of pigeon pea against dry root rot disease with farmer participation were conducted in Vijayapur district of Karnataka for two years during 2018-19 and 2019-20. Results indicated that the Impact of various varities of Pigeon pea on days to maturity was ranged from 160.80 to 179.80, on number of Pods/Plant was ranged from 90.50 to 189.50. Similarly, the Per cent Dry root rot was severe in check plot (Gulyal) (36.00 PDI) and lower in GRG 811 (05.60 PDI). Pooled data indicated that, yield was recorded in GRG 811(15.59 q/ha) which was more than check variety (Gulyal) (7.94 q/ha). Improved variety (GRG 811) recorded higher Gross return of Rs. 73356/ha, net profit of Rs. 54296/ha with benefit cost ratio of 3.73 as against farmer practice (Gulyal) wherein, the Gross return of Rs. 37279.50/ha, net profit of Rs. 16729.50/ha with B:C ratio was 1.81 for every rupee investment.

Keywords: Pigeon pea, dry root rot, economics

Introduction
Pigeon pea [*Cajanus cajan* (L.) Millsp.] is an important legume crop of rainfed agriculture in the semiarid tropics and belongs to family leguminaceae. It is one of the major pulse crop grown in the semi-arid tropics between 30°N and 30°S, covering about 50 countries in Asia, Africa and America. It possesses high protein content and is consumed in the form of split pulse as dal, which is extensively cultivated in upland hilly regions as sole as well as intercrop with maize, sorghum, groundnut, soybean and cotton. Globally the crop is grown on area of 7.03 m. ha. With 4.89 m.t. of total production accounting 695 kg/ha of productivity. In India pigeonpea is the second most important pulse crop after chickpea. In India, this crop is grown in an area of 5.6 m. ha. With an annual production of 3.29 m.t. and productivity is 587 kg ha^{-1}, which accounts for 80 percent of the Pigeon pea area and production of the world. In India, it is mainly grown in Maharashtra, Uttar Pradesh, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu, constitutes 90 percent of the area and production of Pigeon pea. In Karnataka, the crop is considered as most important pulse crop with an area of 8.17 lakh ha with the production of 5.07 lakh tonnes and productivity of 621 kg/ha (Anonymous 2016-17) [1]. Even though, the crop is accounting about 80 percent of world area and production, there is constraint in the productivity over the years. Pigeon pea is known to be infected by more than 200 pathogens reported from 23 different countries (Nene *et al.* 1989) [7]. Among them few are economically important and wide spread causing heavy losses viz., wilt caused by *Fusarium udum*, blight by *Phytophthora drechsleri* F. sp. *cajani*, stem canker by *Macrophomina phaseolina* and pigeonpea sterility mosaic disease transmitted by tenui virus. Recently, *Rhizoctonia bataticola* (Taub.) Butler [*Macrophomina phaseolina* (Tassi) Goid] emerged as soil borne pathogen of different agricultural crops including pigeonpea (Kaur *et al*. 2012) [4]. *R. bataticola* having more than 500 host plants including cultivated and wild plant species belonging to 100 families around the world [Mihail *et al.* 1995 and Pande *et al.* 2004] [6, 8]. The pathogen is very severe especially when an off-season summer crop is taken particularly in black soil. Under favourable condition, disease will infect quickly and cause huge economic losses ranging from 10-100 percent (Smitha *et al*. 2015) [9]. The pathogen is primarily a soil inhabitant generally affects the fibrovascular system of the roots which prevents the transport of nutrients and water to the upper parts of the plant. Recently under field condition dry root rot was noticed in pigeonpea as major proportion in the farmer holdings which has significant effect on plant diversity and yield with current scenario of increasing temperature, due to global warming this disease gaining importance in field.

Due to its soil inhabitancy the management is very difficult. Hence, the present study was attempted to manage the soil borne disease with host plant resistance sources by screening different varities of pigeonpea against *R. bataticola*.

Materials and Methods

Demonstration with different varities of Pigeon pea was carried out with the farmer participation in *Kharif* Pigeon pea through Krishi Vigyan Kendra, Vijayapur for two years during 2018-19 and 2019-20 under rainfed situation. Each demonstration was conducted in an area of 0.4 ha and adjacent to the demonstration plot a check plot (farmer practice) of 0.4 ha was maintained for the comparison. The demonstrations were conducted in different villages of Vijayapur district of Karnataka with 20 farmers (in 08 ha land) for a period of two years. Each year prior to the implementation of programme, all selected farmers were trained on Integrated Crop Management in Pigeon pea in the Krishi Vigyan Kendra and these selected beneficiaries were provided with all the essential inputs. Data on pest and diseases, yield and yield parameters were recorded from both the demonstrated and check plot for the comparison. Each year 05 demonstrations covering 2 ha of land under different Pigeon pea varieties viz., TS 3R, GRG-152, GRG-811 and for check local varity Gulyal was used. The problems were identified through structured questionnaire. The need based practices were selected in consultation with the farmers, through field experience and also by consulting the agriculture experts in the department. The data on Dry root rot infected plants of test varities at different stages were recorded when infecting of the local check had occurred. The second stage data on Dry root rot infected plants were recorded at the initiation of Physiological maturity. The Dry root rot incidence of each varity was calculated by the following formula:

$$\text{Percent Dry root rot incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants examined}} \text{ X } 100$$

The level of resistance and susceptibility of each variety was determined by using 1-9 rating scale given by ICRISAT.

Rating	Infection	Description	Reaction
1	No mortality	No infection on roots	Highly Resistant (HR)
3	0-10% mortality	Very few small lesions on roots	Resistant (R)
5	11-20% mortality	Lesions on roots clear but small; new roots free from infection	Moderately Resistant (MR)
7	20-50% mortality	Lesions on roots many; new roots generally free from lesions	Susceptible (S)
9	>51% mortality	Roots infected and completely discolored	Highly Susceptible (HS)

Apart from dry root rot observations were also recorded on growth and Yield parameters also on different time interval. The data collected from the farmers regarding production cost, inputs used and monitory returns etc for working out the economic feasibility of the recommended technology at the experimental station (Eswaraprasad *et al*., 1993) [3]. Experiment was planted in a Randomized block design having five replication. Each variety was planted in a 90 cm X 60 cm spacing.

Results and Discussion

Days to Maturity and Number of Pods per Plant

Impact of various varities of Pigeon pea on days to maturity was recorded (Table 1), among the various varities of Pigeon pea, variety GRG 152 has early maturity with 159.90 days fallowed by local variety Gulyal with 160.80 days of maturity and the variety GRG 811 was late maturity with 179.80 days.

Among the various varities of Pigeon pea the highest number of pods per plant was recorded in variety GRG 811 with 189.50 followed by GRG 152 with 185.80, TS 3R with 182.40 and the least number of pods per plant was recorded in variety Gulyal with 90.50 pods per plant. The results are in line with the results of Suryavanshi and Mahindre Prakash (1993) [10] and Arun kumar *et al*., (2005) [2] who have reported that the adoption of recommended practices in frontline demonstration trials in oilseeds and in hybrid cotton have shown increased yield over respective check plot.

Root rot disease incidence

The impact of various varities on disease incidence is given in table 1. The dry root rot disease was ranged from5.60 to 36.00 percent. The root rot disease incidence was severe in local variety Gulyal (36.00 PDI) compared to other varities. However, the lowest root rot incidence was recorded in variety GRG 811 (5.60) followed by GRG 152 (10.00) and TS 3R (16.00). The severity of disease in local gulyal variety may be due to fact that many farmers have a tendency to use pesticides indiscriminately at higher dose, it might have caused disease to outbreak in local variety.

Pigeon pea yield and cost economics

Average yield recorded in various varities of pigeon pea was ranged from 7.94 to 15.59 q ha^{-1} (Table 1). Among the varities GRG 811 was recorded highest yield of 15.59 qha^{-1} followed by GRG 152 (14.36 q/ha), TS 3R (13.61 q/ha) and Local variety Golyal was recorded lowest yield of 7.94 q/ha. The total mean cost of cultivation was higher in Pigeon pea variety Gulyal demonstrated plots (Rs. 20550/ha) compared to other Pigeon pea variety. This is due to additional application of vermicompost to the soil at the time of sowing. The comparative profitability of Pigeon pea crop has been studied by estimating the net profit and benefit cost ratio (Table 2). Highest gross returns, net profit and B:C ratio were recorded in pigeon pea variety GRG 811. GRG 811 recorded higher mean gross return of Rs. 73356 per ha. Mean net profit of Rs. 54296 per ha. with mean benefit cost ratio of 3.73 as against farmer practice (Gulyal variety) wherein, the mean gross return Rs. 37279.50, the mean net profit was Rs. 16729.50 per ha with mean B:C ratio was 1.81 for every rupee investment. It can be concluded from the study that increased Pigeon pea yield was due to the adoption of improved varities. The study further reveals that the fluctuation in yield is the major cause for the fluctuation in the output. Hence, the fluctuation in yield has to be controlled to bring in stability in the output (Kaushik, 1993 and Suryawanshi *et.al* 1993) [5, 10].

Table 2: Impact of various varities of Pigeon pea on growth, yield and disease parameters

Treatments	Days to Maturity			Number of Pods/Plant			Yield (Q/ha)			Per cent Dry root rot		
	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled	2018-19	2019-20	Pooled
T1. TS 3R	169.8	168.00	168.90	177.60	182.40	180.00	13.26	13.96	13.61	15.20	16.80	16.00
T2. GRG 152	164.2	155.60	159.90	180.40	185.20	182.80	14.28	14.44	14.36	8.40	11.60	10.00
T3. GRG 811	181	178.60	179.80	187.00	192.00	189.50	16.01	15.17	15.59	4.40	6.80	5.60
T4. Gulyal	161.6	160.00	160.80	88.00	93.00	90.50	6.48	9.39	7.94	34.00	38.00	36.00
SEM	2.02	1.52	1.45	3.81	5.50	4.551	0.89	0.64	0.564	1.75	1.91	1.575
CD @0.05	6.23	4.68	4.47	11.74	16.95	14.022	2.75	1.99	1.7383	5.41	5.91	4.852

Table 3: Impact of various varities of Pigeon pea on yield economics

Treatments	Gross return (Rs/ha)			Cost of cultivation (Rs/ha)			Net Profit (Rs/ha)			B:C ratio		
	2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean	2018-19	2019-20	Mean
T1. TS 3R	83760	46238	64999	18200	17320	17760	65560	28238	46899	4.61	2.66	3.63
T2. GRG 152	86520	51362	68941	19900	18000	18950	66620	33362	49991	4.35	2.85	3.60
T3. GRG 811	91080	55632	73356	20800	18000	19400	70280	38312	54296	4.38	3.09	3.73
T4. Gulyal	38880	35679	37279.50	19900	21200	20550	18980	14479	16729.50	1.95	1.68	1.81

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