

## SCREENING OF COWPEA GENOTYPES FOR GROWTH, YIELD AND COWPEA MOSAIC VIRUS INCIDENCE

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### Abstract

Eighteen cowpea genotypes against cowpea mosaic virus disease under zero tillage condition were screened during pre *Kharif* season of 2013, 2014 and 2015 at the field in Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. Significant variation was observed for different genotypes with respect to cowpea mosaic virus, growth, yield and qualities. Highest pod yield was recorded in Kashi Kanchan (16.42 t/ha) which was statistically *at par* with Kanak (16.30 t/ha). Genotypes Bidhan Barbati 1, Bidhan Barbati 2, Kaberee and Pusa Komal were recorded without disease incidence *i.e.* immune while, Kanak, Pusa Phalguni Gold and Lafa Charulata exhibited highly resistance against cowpea mosaic virus. It was observed that cowpea mosaic virus incidence was negatively correlated with chlorophyll content, number of pods/plant, pod yield, leaf phenol content and leaf peroxidase content whereas, it was positively correlated with canopy temperature, days to flowering and first harvest.

Zero tillage is a way of growing crops or pasture from year to year without disturbing the soil through tillage. It is an extreme form of minimum tillage which increases the water retention capacity, cycling of nutrients and eliminates soil erosion (Baeumer and Bakermans 1994). Cowpea is a multipurpose crop and has ability to tolerate drought and high temperature hence it can be cultivated easily compared to other legumes. Zero tillage can produce more yields with low costs, reduce environmental pollution, promote conjunctive use of organics and improve soil health. In India, a large number of improved varieties and agro-techniques have been developed, the productivity of cowpea has still not reached the desired level. It has been reported that yield loss of cowpea ranges up to 75 per cent due to disease incidence (Emechebe 1981). The cowpea mosaic virus is an important constrain for reduction of yield of cowpea. Hence, this research trail was initiated to select the best performing high yielding and tolerant varieties of cowpea against Cowpea Mosaic Virus under zero tillage conditions.

The experiment was conducted during pre *Kharif* season of 2013, 2014 and 2015 at Instructional Farm of the Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India. An area lies under the Terai agro climatic zone of West Bengal which is characterized by high rainfall (above 3000 mm annually), high relative humidity, moderate temperature, prolonged winter with high residual soil moisture. The topography of the land was medium to high. The soil was sandy loam in nature, coarse in texture, poor in water holding capacity with low pH. The trial was laid out during pre-*kharif* season after harvesting of wheat in Randomized Block Design with three replications. Eighteen Cowpea genotypes were included and planted in middle of April of both the years. FYM @ 15 t/ha and recommended N,

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**Table 1. Growth, yield and disease incidence parameters of different cowpea genotype (Pooled value of 2013, 2014 and 2015).**

Genotypes	Vine length (cm)	First flowering (days)	Last harvesting (days)	Canopy temp. (°C)	Chlorophyll content (SPAD value)	Pod length (cm)	Pod weight (g)	No. of pods/plant	Yield (t/ha)	% disease incidence	Phenol content (mg/g)	Peroxidase activity (min/g)
Triguna	32.91	41.33	70.67	30.48	36.25	26.31	9.08	29.13	15.78	8.89	0.222	17.86
Kanak	63.22	41.56	71.89	29.84	41.14	26.71	9.25	28.58	16.30	4.44	0.227	36.61
Kashi Kanchan	41.19	40.89	70.00	30.99	50.66	30.17	10.77	28.62	16.42	17.78	0.185	13.64
Lafa Sohini 7	79.74	43.44	72.56	32.52	43.04	39.86	12.59	21.71	12.64	22.22	0.174	11.21
Lafa Sundari Bangla	109.43	44.00	72.78	32.12	39.82	42.34	12.83	18.62	12.59	20.00	0.218	9.96
Girija Deshi Lafa	94.32	45.56	74.89	32.33	38.60	42.55	14.15	16.82	9.91	28.89	0.249	6.17
Lafa Barbati	46.58	45.00	73.11	32.66	34.58	41.92	13.57	17.04	10.54	24.44	0.152	29.67
Bidhan Barbati 1	42.37	38.11	66.89	28.77	47.80	25.91	8.53	23.38	11.38	0.00	0.350	46.17
Bidhan Barbati 2	51.70	42.56	70.44	26.88	43.66	27.14	9.32	24.53	13.21	0.00	0.349	41.19
Kaberee	63.73	36.56	66.56	28.23	41.54	31.07	10.13	19.49	8.39	0.00	0.358	36.72
Pusa Phalgumi Gold	72.14	52.78	81.11	28.61	45.59	21.24	6.56	20.20	9.34	2.22	0.347	25.99
Pusa Komal	34.56	42.78	72.22	28.93	48.31	28.84	9.21	24.36	11.13	0.00	0.400	46.89
Kailash	41.27	48.78	76.56	31.29	40.11	24.61	6.95	13.82	5.57	17.78	0.206	10.85
Bali- 265	53.49	48.00	76.89	33.13	36.50	21.71	6.67	16.16	6.97	33.33	0.138	7.45
VU- 5	32.63	50.56	78.78	34.00	36.87	23.19	7.11	10.40	4.09	53.33	0.143	6.13
Gaurav	60.98	47.33	75.33	34.09	32.59	22.13	7.17	12.98	5.01	53.33	0.128	5.07
Ankur Gomati	51.09	48.22	76.67	34.04	31.16	22.93	6.88	14.02	5.22	60.00	0.095	4.71
Lafa Charulata	75.43	51.22	81.56	30.67	41.95	31.79	10.86	14.51	9.99	2.22	0.316	31.97
S.Em (±)	1.62	0.88	1.00	0.87	1.12	0.53	0.10	0.50	0.53	3.08	0.13	1.63
CD (P=0.05)	4.53	2.48	2.80	2.43	3.13	1.49	0.28	1.41	1.50	8.63	0.37	4.68
CV %	4.83	3.42	2.30	4.73	4.78	5.96	3.04	7.12	9.13	43.87	13.22	19.82

P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O @ 20:50:50 kg/ha was applied in all treatments. Seeds were inoculated with (*Rhizobium* + PSB) @ 10 g each/kg of seed and sown by maintaining spacing of 45 cm × 20 cm. Cowpea plants were also inoculated with pathogen inoculums at 15 DAS and 30 DAS. To screen the cowpea genotypes against cowpea mosaic virus disease artificial inoculation was done. Five plants were selected randomly to record growth parameters like vine length, days to flowering and harvesting, number of nodule per plant, canopy temperature, chlorophyll content and yield attributing characters like pod length, pod weight, number of pods per plant and yield. The total phenol content was measured by using Folin-ciocalteau reagent (Malick and Singh 1980) and peroxidase enzyme activity of leaf was measured as per method given by Sadasivam and Manickam (1996). The mean data were analysed as per statistical method suggested by Gomez and Gomez (1984).

**Table 2. Correlation of different parameters with per cent of cowpea mosaic disease incidence.**

Parameters	Values	Parameters	Values
Vine length	-0.035	Individual pod weight	-0.211
Days to flowering	0.446	Number of pods/plant	-0.651**
Days taken to first harvesting	0.458	Yield (t/ha)	-0.628**
Canopy temperature	0.908**	Phenol content	-0.854**
Chlorophyll content	-0.730**	Peroxidase content	-0.789**
Pod length	-0.133		

\*\* indicates significant at 1%.

For disease inoculation, disease sample was collected from infected field and crushed to extract juice. The lower surfaces of the leaf of selected plants were rubbed with carborundum powder and inoculated with extract material. Disease incidence was then scored according to disease rating scale for cowpea mosaic (Muhammad *et al.* 1994). Collected data were computed in formula to calculate final percent of disease incidence. Score 0 = Plants showing no symptoms (immune), Score 1 = 1-5 % plants showing symptoms (resistant), Score 2 = 5-15 % of plants showing symptoms (moderately resistant), Score 3 = 15-20 % plants showing symptoms (moderately susceptible), Score 4 = 25-50 % plants showing symptoms (susceptible) and Score 5 = 50 % of plants showing symptoms (highly susceptible).

Results of pooled analysis revealed that significant variations were found for different quantitative and qualitative characters (Table 1). Maximum vine length was recorded in Lafa Sundari Bangla (109.43 cm) followed by Girija Deshi Lafa (94.32 cm) and Lafa Sohini 7 (79.74 cm). Significantly lowest days for flowering and harvesting was taken by the variety Kaberee (36.56 and 66.56 days) followed by Bidhan Barbati1 (38.11 and 66.89 days), KashiKanchan (40.89 and 70 days) and Triguna (41.33 and 70.67 days).

There was a significant variation in cowpea genotypes with respect to chlorophyll content expressed in SPAD values (Table 1). Kashi Kanchan (50.66 SPAD-502) was recorded as maximum chlorophyll content followed by PusaKomal (48.31 SPAD-502) and Bidhan Barbati 1 (47.80 SPAD-502). The highest canopy temperature was recorded by variety Gaurav (34.09 °C) which was significantly *at par* with Ankur Gomati (34.04°C) and VU-5 (34 °C) followed by Bali-265 (33.13 °C). Significantly lowest canopy temperature was recorded in Bidhan Barbati 2 (26.88 °C) followed by Kaberee (28.23 °C) and Pusa Phalguni Gold (28.61 °C).

Among the genotypes Girija Deshi Lafa produced longest (42.55 cm) and heaviest (14.15 g) pod followed by Lafa Barbati (13.57 g), Lafa Sundari Bangla (12.83 g) and lowest in Pusa Phalguni Gold (6.56 g). These variations in the individual pod weight of different genotype might be due to the variation in the pod length. Genotype Triguna produced maximum number of pods per plant (29.13) which was statistically *at par* with Kashi Kanchan (28.62) and Kanak (28.58). Highest yield was recorded by Kashi Kanchan (16.42 t/ha) which was statistically *at par* with Kanak (16.30 t/ha) and Triguna (15.78 t/ha). Higher pod yield in Kashi Kanchan, Kanak and Triguna might be due to higher number pod per plant, moderate individual pod weight and genetic makeup of the genotypes.

The most susceptible genotype with respect to cowpea mosaic virus was Ankur Gomati (60.00%), followed by Gaurav (53.33%) and VU-5 (53.33%) (Table 1). Bidhan Barbati 1, Bidhan Barbati 2, Kaberee and Pusa Komal performed as immune. Out of 18 genotypes 14 were reported for incidence of diseases though variety Kanak, Pusa Phalguni Gold and Lafa Charulata exhibited highly resistance.

Significantly highest phenol and peroxidase activity was found in Pusa Komal (0.400 mg/g and 46.89 min/g of tissue, respectively). Higher phenol content was also recorded in Kaberee (0.358 mg/g) which was statistically *at par* with Bidhan Barbati 1 (0.350 mg/g), Bidhan Barbati 2 (0.349 mg/g) and Pusa Phalguni Gold (0.347 mg/g). Higher rate of peroxidase activity was recorded in Bidhan Barbati 2 (41.19 min/g of tissue) followed by Kaberee (36.72 min/g) and Kanak (36.61 min/g). Higher phenol and peroxidase activity present in the varieties exhibited lower incidence of cowpea mosaic virus. This might be due to the higher phenol and peroxidase activity in the plant and may act as barrier to the cowpea mosaic virus incidence. Correlation coefficient study revealed that incidence of cowpea mosaic virus positively correlated with canopy temperature and negatively correlated with chlorophyll content, number of pods per plant, pod yield, leaf phenol content and leaf peroxidase content (Table 2).

Overall finding revealed that genotype Kanak performed as best with respect to both yield and disease resistance. Bidhan Barbati 1, Bidhan Barbati 2, Kaberee and Pusa Komal recognised as immune against cowpea mosaic virus and phenol content of leaves and peroxidase activity can restrict the activities of cowpea mosaic virus.

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