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## Assessment of quantitative yield loss of blackgram (*Vigna mungo* (L.) Hepper) due to urd bean leaf crinkle virus

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### Abstract

Blackgram (*Vigna mungo* (L.) Hepper) also known as urdbean is a valuable source of protein in human diet. The crop suffers from variety of viruses. Among the viral diseases Urd bean Leaf Crinkle Virus (ULCV) causes economic yield losses. Significant differences in yield and yield parameters were observed between healthy and diseased plants when the infection occurred before flowering i.e., up to the age of 40 to 45 days under natural conditions. The plants infected with ULCV are shown to yield 85.67 per cent less than the seed yield of healthy plants. The seed yield is affected mainly by reduction in the number of pods/plant, number of seeds/pod and 100 seed weight. The overall plant growth as evidenced by 45.09 per cent reduction in plant height and 44.57 per cent reduction in number of trifoliolate leaves/plant than the healthy plants.

**Keywords:** *Vigna mungo*, yield loss, growth attributes, leaf crinkle virus

### Introduction

Blackgram (*Vigna mungo* (L.) Hepper) also known as urdbean is a valuable source of dietary protein in human diet. The nutritive value of blackgram lies in its high and easily digestible protein, and contain approximately 25-28% protein, 1.0% oil, 3.5-4.5% fibre, 4.5-5.5% ash and 62-65% carbohydrates on dry weight basis. It is also a good source of phosphoric acid and lysine. High value of lysine makes blackgram an excellent complement to rice in terms of balanced human nutrition. It provides a balanced diet, digests easily and produces less flatulence.

These crops are highly vulnerable to a large number of viral diseases which are major constraints in its production and productivity. Among the viral diseases, leaf crinkle is an important disease that infects the crops at various stages of its growth, which reduce both quantity and quality of seed. This disease has become one of the major yield constraints in blackgram especially *Rabi* and summer under uplands and rice fallow situations. The disease can cause crop losses to an extent of 100 per cent depending on the variety and stage of infection (Beniwal and Chaubey, 1979) [5]. Among the various causal agents of blackgram diseases, viruses are known to cause many serious diseases viz., leaf crinkle, yellow mosaic, leaf curl etc., of which leaf crinkle caused by Urdbean Leaf Crinkle Virus (ungrouped-ULCV) is an important disease, considered as very severe among the viral diseases, which results in significant economic losses, whereas others are of minor importance (Bashir *et al.*, 1991 [4], Aftab *et al.*, 1993 [1]) and the severity symptoms depend on the cultivated varieties and their cropping seasons (Reddy *et al.*, 2005) [13]. With this background a study was undertaken to assess of yield loss due ULCV in Tamil Nadu.

### Materials and Methods

#### Assessment of yield losses and parameters

The experiment was carried out at Department of Pulses, TNAU, Coimbatore. Seeds from 10 randomly tagged plants of ULCV completely infected moderately infected as well as healthy plants of urdbean genotypes, during *kharif* 2016 and planting during *Rabi* season (Fig. 1). Seeds were collected from healthy plants with no signs of infection and diseased plants showing distinct crinkling at trifoliolate stage were selected at random, marked and harvested individually at maturity. Various yield contributory components such as plant height, number of branches, number of leaves, pods/plants, pod length, seeds per pod, yield per plant and 100 grain weight were recorded (Singh, 1980) [14].

Per cent yield loss = (Yield per healthy plant - Yield per infected plant)/ Yield per healthy plant × 100

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**Statistical analysis:** The data on per cent transmission of ULCV from the glasshouse experiments were subjected to the analysis of variance after applying angular/square root transformation. The analysis of variance was carried out using AGRES software.

**Results**

Under natural conditions as a result of infection of ULCV,

yield components of the plant like height, number of leaves/plants, number of pods/plant, pod length, number of seeds/pod, test weight (100 seed weight) and seed yield were adversely affected. The loss in yield was mainly due to decrease in number of pods/plants, pod length, number of seeds/pods and test weight (100 seed weight) in diseased plants compared to moderately and healthy plants. The reductions in various yield parameters are presented in (Table 1).



**Fig 1a:** Bushy appearance of completely infected plant.



**Fig 1b:** Moderately infected plant.



**Fig 1c:** Healthy plant of blackgram.



**Fig 2a:** Completely infected plant.**a. Plant height**

There was significant difference between plant heights of healthy, moderately and highly infected plants. Mean height of healthy plants was 22.40 cm compared to 17.40 and 12.30 cm in moderately infected and heavily diseased plants resulting in the loss of 22.32 and 45.09 per cent respectively over healthy plants.

**b. Number of trifoliolate leaves/plant**

The number of trifoliolate leaves differed significantly in the healthy, moderately infected and heavily infected plants. The mean numbers of trifoliolate leaves were 17.50, 13.00 and 9.70 respectively in healthy moderately and heavily diseased plants resulting in the loss of 25.71 and 44.57 in moderately and heavily infected plants over healthy plants.

**c. Number of pods/plant**

Highly significant differences were observed between the number of pods produced by healthy and diseased plants. Healthy plants produced 27.80 pods and 9.70 and 13.00 pods/plant in moderately and heavily infected resulting in the

**Fig 2b:** Moderately infected plant of blackgram

loss of 69.42 and 97.84 per cent respectively over healthy plants due to ULCV infection.

**d. Number of seeds/pods**

The reduction of seeds/pod due to ULCV infection was 88.06 per cent, which was highly significant. In healthy plants 4.69 seeds/pod were recorded as against 0.56 seeds/pod in diseased plants.

**e. Test weight (100 seed weight)**

There was marginal difference in the test weight of seeds collected from healthy and diseased plants. Test weight was 4.69, 3.57 and 0.56 in healthy, moderately and heavily infected plants respectively.

**f. Seed yield/plant**

Highly significant differences were observed between seed yield of healthy and diseased plants. The seed yield was 34.9, 26.2 and 5 g per plant in healthy moderately and heavily diseased plants respectively. The reduction in seed yield was 24.93 and 85.67 per cent over control.

**Table 1:** Effect of ULCV on yield parameters in blackgram

Particulars	Plant height (cm)	branches/plant	leaves/plant	pods/plant	seeds/pod	pod length	100 seed weight (g)	Seed yield (g/plant)
Completely infected plants	12.30	1.20	9.70	0.60	0.56	0.56	2.65	5
Moderately infected plants	17.40	3.60	13.00	8.50	3.57	3.57	4.86	26.2
Healthy plants	22.40	7.10	17.50	27.80	4.69	4.69	6.33	34.9
Per cent decrease over healthy(CI)	45.09	83.10	44.57	97.84	88.06	88.05	58.14	85.67
(MI)	22.32	49.30	25.71	69.42	23.88	23.82	23.22	24.93

CI- Completely Infected plant

MI- Moderately Infected plant

**Discussion**

Yield loss due to infection in blackgram at different stages of crop growth adversely affected various growth parameters both in naturally infected plants in the field as well as in artificially inoculated plants in the glasshouse. In the present study significant reduction in the plant height, number of pods/plant, number of seeds/ pods was observed in plants infected in early stages of crop growth (Fig 2.). The plants infected with ULCV are shown to yield 85.67 per cent less than the seed yield of healthy plants (Table 1). The seed yield is affected mainly by reduction in the number of pods/plant, number of seeds/pod and 100 seed weight. The overall plant growth as evidenced by 45.09 per cent reduction in plant height and 44.57 per cent reduction in number of trifoliolate leaves/ plant than the healthy plants. The results are in conformity with Kolte (1971) [8]; Nene (1973) [11]; Singh (1980) [14]; Kadian (1982) [7] and Subba Rao (1984) [15] while working with this disease. The reduction in plant height and number of trifoliolate leaves/plant as a result of infection is one of the factors leading to reduced synthesis of food materials and this also depends on the age of infection and cultivar. Reduction in pod and seed yield of blackgram infected by leaf crinkle disease attributed to poor flowering and sterility of the inflorescence because of the systemic nature of the disease. The less number of seeds/pod in infected plants may be due to the abortion of ovules caused by the viral infection and this may be attributed to the reduction in seed yield to reduced size and this may be attributed to the reduction in seeds/pod. Beniwal and Chaubey (1979) [5] observed reduction in number of pods per plant and number of seeds per pods in ULCV infected blackgram plants. A different degree of pollen

sterility depending on the age of plant at the time of infection was also reported by different authors (Narayanaswamy and Jaganathan, 1975 [10]; Ravinder Reddy, 1988 [12]). Blackgram and greengram being self-pollinated; the pollen sterility affects the number of pods in the ULCV infected plants.

Though reduction in the number of pods per plant and number of seeds per pod was observed in ULCV infected blackgram and greengram plants, there was a significant decrease in 100 seed weight in early infections both under glasshouse and field conditions. The decrease in 100 seed weight in ULCV infected plants is in contrast with the findings of Beniwal and Chaubey (1979) [5] and Ravinder Reddy (1988) [12]. Significant decrease 100 seed weight has also been reported in legume crops blackgram infected by bean common mosaic virus (Agarwal *et al.*, 1976) [2].

Kadian (1982) [7] reported a yield loss of 2.12 and 93.98 per cent and 2.82 to 95.17 per cent due to leaf crinkle disease at Hissar in greengram and blackgram respectively. He also observed a correlation between the stage of plant growth at which infection occurred and loss in grain yield. Chattopadhyay *et al.* (1986) [6] reported loss in yield which ranged from 14.6 to 55.8 per cent in 14 cultivars of greengram. The infection of blackgram with ULCV reduced the plant height by 8 per cent, decreased number of pods per plants by 90 percent and decreased the number of seeds per pod by 26 per cent with an average yield loss of 81 per cent per plant when compared to uninfected plants (Bashir *et al.*, 1991) [4]. Ashok Mishra *et al.* (1994) [3] reported the reduction in pod size, number of seeds per pod and seed weight in ULCV infected T9 blackgram. Manadhare *et al.* (1999) [9]

reported a yield reduction of 47.34 per cent in ULCV infected greengram plants.

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