Assessment of Selected Yellow Vein Mosaic Virus Resistant Varieties of Okra in Rabi Season of Chatra District in Jharkhand, India

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Authors’ contributions

This work was carried out in collaboration among all authors. Author DO designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AK and RKS managed the analyses of the study. Authors UKS and ZA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

An On-Farm Trial (OFT) was conducted in the year 2016-17 and 2017-18 to assess the resistance level of different okra varieties against yellow vein mosaic virus in Kharif season of Chatra district of Jharkhand. The experiment was conducted in vegetable growing village Gidhour in Gidhour block of Chatra district in Jharkhand. The trial was designed in randomized block design consisting of 20 replications with three technological option i.e. TO-I Arka Abhay (N\textsuperscript{100}P\textsuperscript{60}K\textsuperscript{50}), TO-II Arka Anamika (N\textsuperscript{100}P\textsuperscript{60}K\textsuperscript{50}) and-III Pusa Makhmali (N\textsuperscript{100}P\textsuperscript{60}K\textsuperscript{50}). For assessment related to yellow vein mosaic, percentage infestation in 5sqm and yield q/ha and economic was considered. The lowest infestation of yellow vein mosaic virus was observed in Pusa Makhmali variety i.e. (3.8\%) with yield of 132.5 q/ha. It was also found superior in terms of Gross Income, Net Income and Benefit: Cost Ratio followed by Arka Anamika and Arka Abhay, respectively. Farmers’ response was also positive in all respects except the availability of varieties in local market.

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1. INTRODUCTION

Okra or Bhindi is an annual herbaceous plant. It is one of the most popular vegetable crops cultivated throughout the world, because of high consumer demand and better price. It is widely cultivated as a summer season crop in North India and as a Kharif and summer season crop in Maharashtra, Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu. It grows well in the areas where day temperatures remain between 25 to 40°C and that of the night over 22°C (Naim et al., 2013). Amongst the various constraints in the cultivation of okra, viral disease, particularly; yellow vein mosaic is a major one [1,2,3]. Farmers grow okra round the year. In India okra is grown in 498 thousand ha and production on 5784 thousand tons, Andhra Pradesh is the leading okra producing state which has produced around 1184.2 thousand tons followed by West Bengal (862.1 thousand tons) and Bihar (788.3 thousand tons). Despite its high nutritive value, well acceptability among end-users and wide range of available genetic variability, the country is still lagging behind the leading productive countries like Ghana and Egypt in the world [4].

In Jharkhand, 421.7 mt. okra was produced from over 30.0 thousand ha. area with 14.10 mt/ha. Jharkhand produced 7.3 per cent of the total okra production of the country. In Chatra district of Jharkhand okra is treated like a cash crop and covers about 13 thousand ha area. A complex of monopartite begomovirus, yellow vein mosaic virus (Family: Geminiviridae) and a small satellite DNA β component are the major factors responsible for disease development in okra [5]. The spread of the disease depends on upon the environmental conditions, crop characteristics and vector population [6, 7]. There is a Variable reaction of virus to different okra genotypes under different agro climatic conditions, so it was considered imperative to assess the different varieties and lines under different seasons to find out durable resistant genotypes against this disease [8]. This crop suffers from different disease and pest which reduce quality and yield and farmers get poor price in the market. The crop is very much susceptible to white fly (Bemisia tabaci Gan.), the vector of yellow vein mosaic virus. It is a serious disease which deteriorates quality and yield of the crops. Chemical control of white fly through various insecticides is not very effective. Major losses in okra fruits yield and quality is caused by this disease and its insect vector. In severe cases crop may infect up to 100% with the total yield loss of 50 to 94% which influence by growth stage and environmental conditions [9,10,11]. In the other hand, it affects human health and the environment also. Keeping this fact under consideration KVK Chatra conducted an On Farm Trial (OFT) to evaluate the performance of selected yellow vein resistant okra varieties in bio-physical and socio-economic conditions of Chatra district in Jharkhand.

2. MATERIALS AND METHODS

The field experiment was conducted during 2016-17 and 2017-18 in farmers’ field of Gidhour village in Gidhour panchayat under Gidhour block of Chatra district in Jharkhand, where okra is grown round the year. The soil of the village was sandy loam to sandy clay loam analyzing low in available N(271 kg/ha), low to medium in available P (8-9 kg/ha) and medium to high in available K(175-182 kg/ha) with pH ranging from 5.3 to 6.4. The On Farm Trial was designed with three treatments-l Arka Abhay (N100P50K50), TO-II Arka Anamika (N100P50K50) and TO-III Pusa Makhmali (N100P50K50) along with farmers’ practices.

The trial was conducted under a randomized block design with 20 replications/ location in 2000 m² area. The row to row and plant to plant spacing was 45 cm and 15 cm, respectively. Along with 10 tonnes/ha farm yard manure, recommended dose of N100P50K50 was applied.

Half dose of N and full doses of P and K were applied at the time of field preparation and the remaining half dose was top-dressed in two equal amounts, first at earthing up and second after one month. The intercultural operation and irrigation were carried out in accordance with the recommended schedule. In order to observe insect population incidence related to YVMV disease, no pesticide was sprayed. Parameters like disease severity and intensity, fruit setting and maturity were observed and estimated on 10 randomly selected plants and cumulative data was obtained. Further, to access the resistance of a given strain, disease scoring for yellow vein mosaic virus was done on a 0-9 scale [12] on the basis of virtual observation.

Economic analysis was done through calculation of gross income, net income and BC ratio of different treatments.
3. RESULTS AND DISCUSSION

As per results obtained in the present experiment (Table 1), among all three varieties tested Pusa Makhmali showed least per cent infestation of yellow vein mosaic virus i.e. 3% at flowering stage, 5% at fruiting stage and 7% at maturity stage followed by Arka Anamika (5, 6 and 8.5 per cent, respectively). Further, Arka Abhay was found moderately resistant against yellow vein mosaic disease. These findings were in agreement with observations reported by Natarajan et al. [13] that Arka Anamika was tolerant against YVMC disease.

### 3.1 Economics of Intervent Technologies

The data pertaining to yield and economics of intervent technologies (Table 2) shows that highest yield was observed with Pusa Makhmali (132.5 q/ha) followed by Arka Anamika (127.8 q/ha) and Arka Abhaya (118.9 q/ha). Similarly, highest gross and net income were also recorded with Pusa Makhmali (Rs. 132500.00 and Rs. 99860.00) followed by Arka Anamika (Rs. 27800.00 and Rs. 95160.00), Arka Abhaya (Rs. 118900.00 and Rs. 86260.00). The superiority of Pusa Makhmali also reflected with highest B:C ratio (4.05) followed by Arka Anamika (3.91) and Arka abhay (3.64), respectively.

### Table 1. The description of scale

| Scale | Reaction category | Type of infection |
|-------|-------------------|-------------------|
| 0     | No disease        | No plants infected|
| 1     | Highly resistant (HR) | <1% plants showing symptoms|
| 3     | Resistant (R)     | 1-10% plants showing mottling of leaves|
| 5     | Moderately Resistant (MR) | 11-20% plants showing mottling and yellow discolouration of leaves|
| 7     | Susceptible (S)   | 21-50% plants showing mottling and yellow discolouration of leaves and stunting of plants|
| 9     | Highly Susceptible (HS) | > 50% plants affected, stunting of plants pronounced, flower and fruit set reduced and yellow mottling severe|

### Table 2. Average indices of yellow vein mosaic virus (%) disease in different selected Okra varieties (2015-16 to 2016-17)

| Treatment          | At seedling stage | At flowering stage | At fruit stage | At maturity state | Reacting category |
|--------------------|-------------------|--------------------|---------------|-------------------|-------------------|
| Farmers Practice   | -                 | 17(4.1)            | 21 (5.2)      | 58.5 (7.6)        | HS                |
| TO I Arka Abhay    | -                 | 3.5(2.1)           | 9.5 (3.2)     | 11.5 (3.5)        | MR                |
| TO II Arka Anamika | -                 | 7(2.8)             | 6 (2.6)       | 8.5 (3.1)         | R                 |
| TO III Pusa Makhmali | -              | 3(2.0)             | 5 (2.4)       | 7.0 (3.8)         | R                 |
| CD (5%)            | 0.32              | 0.49               | 0.51          |                   |                   |

* The figures in parentheses are square root transformed

### Table 3. Average yield and economic of selected Okra varieties

| Treatment          | Yield (q/ha) | Cost of cultivation (Rs./ha) | Gross Income (Rs./ha) | Net Income (Rs./ha) | B:C Ratio |
|--------------------|-------------|------------------------------|-----------------------|---------------------|-----------|
| Farmers Practice   | 86.50       | G                            | 86500.00              | 56739.00            | 2.90      |
| TO-I- Arka Abhay   | 118.90      | 32640.00                     | 118900.00             | 86260.00            | 3.64      |
| TO-II- Arka Anamika| 127.80      | 32640.00                     | 127800.00             | 95160.00            | 3.91      |
| TO-III Pusa Makhmali| 132.50    | 32640.00                     | 132500.00             | 99860.00            | 4.05      |

* Note: Family labor cost not included in cost of cultivation
4. CONCLUSION

The yellow vein mosaic virus disease cannot be controlled adequately by chemical means. The uprooting of infested plants is not practical and economical because of heavy infection rates in the field situation. So, the only practical solution of this problem is to develop tolerant varieties and conduct district level trial under different agro-ecological situations to identify best resistant varieties for a particular situation. As per the performance of varieties under the present study, Pusa Makhmali and Arka Anamika are recommended to the farmers of the district.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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