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INTEGRATED MANAGEMENT OF BACTERIAL BLIGHT OF COWPEA CAUSED BY *XANTHOMONAS AXONOPODIS* PV. *VIGNICOLA* (BURKH.) VAUTERIN *ET AL.*,

Nandini R and Shripad Kulkarni*
Department of Plant Pathology, College of Agriculture, University of Agricultural Sciences (UAS), Dharwad – 580 005, Karnataka, India.

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Abstract: Field experiments conducted during 2011-12 involving Hot water treatment + Seed treatment with *Pseudomonas fluorescens* (0.5%) + Foliar spray of *Pseudomonas fluorescens* at 25 days and Streptocycline + Copper oxychloride (0.05 + 0.3%) spray at 45 days, reduced the severity of cowpea bacterial blight significantly and improved both the germination per cent and yield. It is imperative from the study that usage of all management strategies *viz.,* chemicals, biological and cultural together will give better management of the disease than following either of the methods separately.

Key words: Bacterial Blight; *Xanthomonas Axonopodis*; Cowpea

INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp.] (2n=22) commonly called as Lobia is one of the most ancient human food sources and short duration multipurpose pulse crop grown extensively in tropical and subtropical countries. It belongs to family Fabaceae. The name cowpea originated from the fact that the plant was an important source of hay for cows in the south-eastern United States and in other parts of the world (Timko *et al.,* 2007). It is native to Africa, as wild cowpeas only exist in Africa and Madagascar (Steele 1976). It was introduced to the Indian sub-continent from Africa approximately 2000 to 3500 years ago. In the world, cowpea is grown in 10.73 million hectares with the productivity of 387 kg /ha and production of 3.84 million tonnes. In India, it is grown in an area of about 1.5 million hectares with productivity of 567 kg/ha and production of 0.5 million tonnes while in Karnataka it is cultivated over an area of 1.90 lakh hectares with a production of 0.95 lakh tonnes. The productivity potential of the crop in Karnataka is 420kg/ha (Anon, 2011).

The overall grain yields of cowpea in the present traditional systems is low (Singh *et al.*, 1997) due to a complex of biotic and abiotic factors. The abiotic factors that cause yield reduction include poor soil fertility, drought, temperature extremes, excessive moisture, late maturity, acidity and stress due to intercropping with cereals. The biotic factors include insect pests, parasitic flowering plants, as well as viral, fungal, bacterial and nematode diseases.

Among these several constraints, losses due to pests and diseases are very high. Although, 25 to 30 per cent of total cost of production is being spent on plant protection especially pesticides, the biotic constraints could not be managed effectively. Among the diseases infecting cowpea, the bacterial disease popularly known as 'bacterial blight' caused by *Xanthomonas axonopodis* pv. *vignicola* (Burkholder,1944) Vauterin *et al.*, 1995 formerly *X. campestris* pv. *vignicola* (Burkholder, 1944) Dye is a major production constraint. In order to develop an effective management strategy, hot water treatment, bioagents, botanicals, chemicals and their combination have been included in present study as strategic components of integrated disease management (IDM).

***Corresponding Author:**
Dr. Shripad Kulkarni,
Professor of Plant Pathology,
Institute of Organic Farming,
University of Agricultural Sciences (UAS),
Dharwad, Karnataka, India.

MATERIAL AND METHODS

The experiment on IDM was conducted during *Kharif* 2011-12 (June-August) in experimental plot, Institute of Organic Farming, UAS, Dharwad. The trial was laid out in Randomized completely block design (RCBD) with three replications in each treatment. The variety grown was 'C-152' which is susceptible to bacterial blight disease. Sowing, spacing, fertilizer application and inter cultural operations were carried out as per the package of practice. The details of the treatments were given below.

Treatments	Treatment details
T_1	Hot water treatment
T_2	T_1 + Seed treatment with effective bio agent
T_3	T_1 + Seed treatment with effective chemical
T_4	T_3 + Foliar spray with first best botanical
T_5	T_3 + Foliar spray with first best chemical
T_6	Hot water treatment + Seed treatment with effective bioagent + Foliar spray of bioagent/botanical spray at 25 days and one chemical spray at 45 days
T_7	Untreated check (Control)

Hot water treatment of seeds was done at 52°C for 10 min. *Pseudomonas fluorescens* which was effective under *in vitro* conditions was used at 0.5%

concentration obtained from Institute of Organic farming, University of Agricultural Sciences, Dharwad. The botanical, garlic which inhibited bacterial blight pathogen *Xanthomonas axonopodis* pv. *vignicola* under *in vitro* conditions was also included in management study at 0.5% concentration. The chemical *i.e.*, Streptocycline + Copper oxy chloride (0.05 + 0.3%) was used which recorded highest inhibition zone against *Xanthomonas axonopodis* pv. *vignicola* under *in vitro* study.

Germination count was taken at 12 days after sowing. The observations pertaining to the incidence and severity of the disease were recorded and the Per cent Disease Index (PDI) was worked out in each treatment. The data obtained were analyzed statistically.

The data on seed yield in treated and control plots were also recorded and analyzed as per the statistical procedures (Sukhatme and Amble, 1985).

Per cent disease index (PDI) was calculated as follows.

$$\text{Per cent disease index} = \frac{\text{Sum of individual disease ratings}}{\text{No. of leaves examined X Maximum grade value}} \times 100$$

RESULTS AND DISCUSSION

The results of the present investigation are presented in table 1. Highest germination percent (72.00 %) was recorded in T_6 involving Hot water treatment + Seed treatment with *Pseudomonas fluorescens* (0.5%) + Foliar spray of *Pseudomonas fluorescens* at 25 days and Streptocycline + Copper oxychloride (0.05 + 0.3%) spray at 45 days followed by T_2 involving Hot water treatment + Seed treatment with *Pseudomonas fluorescens* (0.5%) (70.17 %) compared to treatment T_7 (control) in which germination percent was 75.33 %.

Table 1: Integrated management of bacterial blight of cowpea under field conditions

Treatment	Treatment details	Germination percentage	Percent Disease index	Yield (q/ha)
T_1	Hot water treatment	67.50 (55.24)*	35.87 (36.79)	5.90
T_2	T_1+ seed treatment with *Pseudomonas fluorescens* (0.5%)	70.17 (56.89)	32.50 (34.76)	6.32
T_3	T_1 + seed treatment with Streptocycline + Copper Oxy Chloride (0.05 + 0.3%)	68.67 (55.96)	29.03 (32.60)	6.16
T_4	T_3 + foliar spray with Garlic extract (0.5%)	69.33 (56.37)	28.60 (32.33)	6.29
T_5	T_3 + foliar spray with Streptocycline + Copper Oxy Chloride (0.05 + 0.3%)	69.83 (56.68)	21.10 (27.35)	6.71
T_6	Hot water treatment + seed treatment with *Pseudomonas fluorescens* (0.5%) + foliar spray of *Pseudomonas fluorescens* at 25 days and Streptocycline + COC (0.05 + 0.3 %) spray at 45 days	72.00 (58.05)	9.25 (17.70)	8.03
T_7	Control	75.33 (60.22)	68.72 (55.99)	4.76
SEm±		0.75	0.90	0.10
CD @ 5%		2.30	2.76	0.31
CV %		2.27	4.57	2.73

***** - Figures in the parenthesis are corresponding arcsine transformed values.

The highest bacterial blight incidence was noticed in control (T_7) (68.72%) while the least disease incidence was noticed in T_6 (9.25%) involving Hot water treatment + Seed treatment with *Pseudomonas fluorescens* (0.5%) + Foliar spray of *Pseudomonas fluorescens* at 25 days and Streptocycline + Copper oxychloride (0.05 + 0.3%) spray at 45 days recorded The next best treatment was T_5 involving Hot water treatment + Seed treatment with Streptocycline + Copper oxychloride (0.05 + 0.3%) + Foliar spray with Streptocycline + Copper oxychloride (0.05 + 0.3%) which recorded a disease incidence of 21.10 per cent.

The yield was significantly higher in T_6 *i.e.*, Hot water treatment + Seed treatment with *Pseudomonas fluorescens* (0.5%) + Foliar spray of *Pseudomonas fluorescens* at 25 days and Streptocycline + Copper oxychloride (0.05 + 0.3%) spray at 45 days (8.03 q per ha) followed by T_5 *i.e.*, Hot water treatment + Seed treatment with Streptocycline at 0.05% + Copper oxychloride at 0.3% + Foliar spray of Streptocycline at 0.05% + Copper oxychloride at 0.3% (6.71 q per ha) whereas, in control plot yield was very less (4.90 q per ha).

Shah *et al.*, (1991) assessed the efficacy of chemicals as seed treatment, foliar spray and combination of the two as well as hot water treatment against the bacterial blight of cowpea during *Kharif* 1986 and 1987 and opined that hot water treatment was found effective but it greatly reduced the germination of seeds whereas, seed treatment with streptocycline supported maximum germination of seeds. They also reported that, combination of seed treatment and foliar spray with streptocycline gave the best control (75%) of the disease with better yield of 6.3 q/ha.

Chakravarti *et al.,* (1976) stated that bacterial blight of cowpea could be controlled by spraying Agrimycin-100 at 250ppm thrice at an interval of 10 days. They recorded up to 35 per cent in yield over control. Jindal and Thind (1990) reported that, three sprays of Streptocycline (100µg/ml) + Bavistin (500µg/ml) and 2 sprays of Streptocycline (100 µg/ml) + Bavistin (500µg/ml) followed by a third spray of Streptocycline (100 µg/ml) + Blitox-50 W.P. (2000 µg/ml) and hot water treatment (50°C for 30 min) provided significantly better disease control with higher seed yield against bacterial blight of cowpea under field conditions.

Ravikumar and Khan (1995) reported that the seed treatment with Streptomycin sulphate or Stretopcycline for 120 min at 300, 400 and 500 ppm eliminated the *Xanthomonas campestris* pv. *vesicatoria* from tomato seeds.

Integration of various management practices has resulted in minimum PDI (9.25%) with highest germination (72%) and yield (8.03 q/ha). Hot water treatment eliminates internally present bacterium, whereas *Pseudomonas fluorescens* suppressed the inoculum present on the outer surface of the seed and *Pseudomonas fluorescens* has grown on the phylloplane rendering protection against air borne bacterium. However, remaining bacterial propagules were killed through spraying Streptocycline + Copper oxychloride at 45 days of crop which was found to be very much susceptible stage of the crop. Efficiency of integrated approach (9.25%) was conspicuous in the present study looking to the disease pressure in the control plot (68.72%) which was very much reflected in highest yield of 8.03 q/ha compared to control (4.90 q/ha).

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