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Effect of Micronutrients on *Urdbean* Leaf Crinkle Disease

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ABSTRACT

A green house experiment was conducted with *urdbean* leaf crinkle susceptible variety LBG 623 during *rabi* 2014-15 with a view to alleviating the effects of *Urdbean Leaf Crinkle Virus* (ULCV) in blackgram through foliar application of Borax @ 0.2%, $MgSO_4$ @ 0.2%, $MnSO_4$ @ 0.2% and $ZnSO_4$ @ 0.2% either alone or in combination with each other. The treatment $ZnSO_4$ @ 0.2% was found effective in reducing the disease incidence (81.25%) followed by combination treatment of Borax @ 0.2% + $MgSO_4$ @ 0.2% + $MnSO_4$ @ 0.2% + $ZnSO_4$ @ 0.2% that reduced the disease incidence to 66.67% over unsprayed control (80.0%).

Keywords: *Borax, Magnesium sulphate ($MgSO_4$), Manganese sulphate ($MnSO_4$), ULCV, urdbean, Zinc sulphate ($ZnSO_4$),*

Blackgram or *urdbean* (*Vigna mungo* (L.) Hepper) is an important pulse crop grown all over the world. It is a major pulse crop of Andhra Pradesh, largely cultivated in rice fallows during *rabi* season as a relay crop in Krishna-Godavari and North coastal zones and to some extent during *kharif* and summer seasons in other parts of the state. Among various diseases infecting *urdbean*, leaf crinkle disease has become a potential threat to the *urdbean* cultivation, as most of the high yielding cultivars are susceptible to this disease. Blackgram is relatively more susceptible than other pulses to leaf crinkle disease caused by *Urdbean Leaf Crinkle Virus* (ULCV) (Bashir *et al*., 2005). The ULCV has been reported to decrease grain yield from 35-81% depending upon genotype and time of infection (Bashir *et al*., 1991). Improved resistance of crops due to balanced nutrition requires less agro chemicals for plant protection. It is an unfriendly and expensive practice to use chemicals against vector of the disease. This situation demands search for cheaper alternatives for management of plant viruses that can be made available to the small growers as well. The ability of the plant to express its induced resistance to a particular disease is affected by mineral nutrition (Rengel, 1999). Nutrient elements either single or combined application of boron with molybedenum had significant effect in reducing viral diseases in winter *mungbean* (Ahmad *et al.,* 1987). Micronutrients play an important role in plant metabolism by affecting the phenolics and lignin content and also membrane stability (Mortvedt *et al*., 1991). The increased resistance to virus infection, following the application of certain micronutrients has been shown to be associated with the formation of new proteins in treated plants (Gianinazzi and Kassanis, 1974). The PR proteins may be involved in active defence mechanism of plants (Kassanis *et al*., 1974). Reuveni and Reuveni (1998) suggested that application of nutrients such as Mn, Cu and B can exchange and therefore release Ca^{2+} cations from cell walls, which interact with salicylic acid and activate systemic acquired resistance mechanisms. Therefore, in order to attain successful management of the ULCV disease, the study was designed to evaluate the micro nutrients management for *urdbean* leaf crinkle disease.

MATERIAL AND METHODS

The experiment was conducted at Agricultural College, Bapatla during *rabi* 2014-15, under green house conditions with variety LBG 623. The experiment comprised of 10 treatments laid out in completely randomized design with four replications. The treatments include T1 = Borax @ 0.2%, T2 = $MgSO_4$ @ 0.2%, T3 = $MnSO_4$ @ 0.2%, T4 = $ZnSO_4$ 0.2%, T5 = Borax @ 0.2% + $MgSO_4$

@ 0.2%, T6 = Borax @ 0.2% + $MnSO_4$ @ 0.2%, T7 = Borax @ 0.2% + $ZnSO_4$ @ 0.2%, T8 = Borax @ 0.2% + $MgSO_4$ @ 0.2% + $MnSO_4$ @ 0.2% + $ZnSO_4$ @ 0.2%, T9 = Unsprayed control (ULCV buffered sap inoculation without micronutrients) and T10 = Uninoculated control. Ten day old seedlings of blackgram were first inoculated with ULCV sap extract and 24 h later the treatments were administered. Incidence of ULCV was recorded at weekly intervals after micronutrient spray.

ULCV incidence was scored by counting the total number of plants infected in each treatment and per cent disease incidence was calculated by the following formula.

$$(PDI) = \frac{\text{Number of plants infected}}{\text{Total number of plants}} \times 100$$

PDI = Percent Disease Indence

RESULTS AND DISCUSSION

Symptoms of ULCV were observed at 21 days after micronutrient spray (DAMS). In case of micronutrient unsprayed but sap inoculated control (unsprayed control) the disease incidence was 15% and was on par with Borax (0.2%) alone sprayed treatment (15%). In other treatments, disease incidence was significantly lower than that in unsprayed pathogen control while in plants sprayed with $MgSO_4$ @ 0.2%, $MnSO_4$ @ 0.2%, $ZnSO_4$ @ 0.2% and Borax @ 0.2% + $MnSO_4$ @ 0.2% disease incidence was absent. In combination treatments (except in Borax @ 0.2% + $MnSO_4$ @ 0.2%), the disease incidence was 6.67% (Table 1).

At 28 DAMS, the disease newly appeared in treatments T2 ($MgSO_4$ @ 0.2%), T3 ($MnSO_4$ @ 0.2%) and T6 (Borax @ 0.2% + $MnSO_4$ @ 0.2%) with an incidence of 15.00, 16.67 and 13.33%, respectively but the treatment T4 ($ZnSO_4$ @ 0.2%) showed no ULCV incidence. At 35 DAMS, significantly the lowest disease incidence was observed with $ZnSO_4$ @ 0.2% alone spraying (10.00%) followed by combined spraying of Borax @ 0.2% + $MgSO_4$ @ 0.2% + $MnSO_4$ @ 0.2% + $ZnSO_4$ @ 0.2% (13.33%) and $MnSO_4$ @ 0.2% (30.00%). This shows that $ZnSO_4$ alone @ 0.2% spraying showed recession of ULCV up to 34 days after spraying and the disease initiated at 35 DAMS. Increase in disease incidence was observed from 35 (10.00%) to 42 DAMS (15.00%) in $ZnSO_4$ @ 0.2% spraying and disease incidence remained static up to 56 DAMS (Table 1).

At 56 DAMS, the lowest disease incidence was observed in $ZnSO_4$ @ 0.2% alone (15.00%) sprayed pots followed by combined treatment of Borax @ 0.2% + $MgSO_4$ @ 0.2% + $MnSO_4$ @ 0.2% + $ZnSO_4$ @ 0.2% (26.67%) and Borax alone @ 0.2% (41.67%). The treatments $MnSO_4$ @ 0.2%, Borax @ 0.2% + $ZnSO_4$ @ 0.2%, Borax @ 0.2% + $MgSO_4$ @ 0.2%, $MgSO_4$ @ 0.2%, Borax @ 0.2% + $MnSO_4$ @ 0.2% recorded 51.67%, 53.33%, 55.00%, 60.00%, 61.67% of incidence, respectively. The maximum disease incidence (80.00%) of ULCV was found in unsprayed control where no micronutrient was applied (Table 1).

Spraying $ZnSO_4$ @ 0.2% alone at 24 hours after inoculation delayed the expression of ULCV up to 34 days after spraying. Incubation period of ULCV in $ZnSO_4$ @ 0.2% treatment ranged from 34 to 41 days with highest per cent disease reduction of ULCV over control (81.25%). Disease reduction with single or combined application of zinc sulphate was reported by Lokeshbabu (1997); Bobade *et al*. (2009); Irshad *et al*. (2012); and Zeshan *et al*. (2012).

It was found that single foliar application of $ZnSO_4$ @ 0.2% showed more disease reduction compared to combined application of $ZnSO_4$ with other micronutrients. Similar results were reported by Jones and Woltz (1970) where combination of Fe + Mn + Zn increased Fusarium wilt of tomato incited by *Fusarium oxysporum* f. sp. *lycopersici*. Pramanik and Ali (2001) reported that combined application of S + B (H_3BO_3) + Mo (Na_2MoO_2. $2H_2O$) showed the highest disease incidence of yellow mosaic than single application of each micronutrient. Tengoua *et al*. (2014) reported maximum incidence of basal stem rot disease of oil palm when B ($Na_2B_4O_7$. $5H_2O$), Cu ($CuSO_4$. $5H_2O$) and Mn ($MnSO_4$. H_2O) were applied in triple combination. The variations showed that the combination of micronutrients increased the disease and needs to be further studied.

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Table 1. Effect of micronutrients on incidence of ULCV

Treatments	Per cent disease incidence recorded at weekly intervals						Disease reduction over unsprayed control (%)
	21 DAMS	28 DAMS	35 DAMS	42 DAMS	49 DAMS	56 DAMS	
T1: Borax @ 0.2% alone	15.00* (22.69)^{a}	20.00 (26.55)^{bc}	38.33 (38.22)^{d}	41.67 (40.18)^{d}	41.67 (40.18)^{d}	41.67 (40.18)^{d}	47.92
T2: $MgSO_4$ @ 0.2% alone	0.00 (0.00)^{c}	15.00 (22.69)^{d}	48.33 (44.03)^{b}	56.67 (48.82)^{b}	60.00 (50.75)^{b}	60.00 (50.75)^{b}	25.00
T3: $MnSO_4$ @ 0.2% alone	0.00 (0.00)^{c}	16.67 (23.98)^{cd}	30.00 (33.16)^{e}	41.67 (40.18)^{d}	51.67 (45.94)^{c}	51.67 (45.94)^{c}	35.42
T4: $ZnSO_4$ @ 0.2% alone	0.00 (0.00)^{c}	0.00 (0.00)^{f}	10.00 (18.18)^{f}	15.00 (22.69)^{f}	15.00 (22.69)^{f}	15.00 (22.69)^{f}	81.25
T5: Borax @ 0.2% + $MgSO_4$ @ 0.2%	6.67 (14.96)^{b}	23.33 (28.82)^{b}	46.67 (43.06)^{bc}	48.33 (44.02)^{c}	55.00 (47.86)^{bc}	55.00 (47.86)^{c}	31.25
T6: Borax @ 0.2% + $MnSO_4$ @ 0.2%	0.00 (0.00)^{c}	13.33 (21.41)^{d}	41.67 (40.18)^{cd}	46.67 (43.06)^{cd}	56.67 (48.82)^{bc}	61.67 (51.74)^{b}	22.92
T7: Borax @ 0.2% + $ZnSO_4$ @ 0.2%	6.67 (14.96)^{b}	20.00 (26.55)^{bc}	46.67 43.07)^{bc}	51.67 (45.95)^{bc}	53.33 (46.91)^{c}	5 3.33 (46.90)^{c}	33.33
T8: Borax @ 0.2% + $MgSO_4$ @ 0.2% + $MnSO_4$ @ 0.2% + $ZnSO_4$ @ 0.2%	6.67 (14.96)^{b}	8.33 (16.57)^{e}	13.33 (21.41)^{f}	26.67 (31.08)^{e}	26.67 (31.08)^{e}	26.67 (31.08)^{e}	66.67
T9: Unsprayed Control (but inoculated with virus)	15.00 (22.69)^{a}	41.67 (40.18)^{a}	70.00 (56.89)^{a}	73.33 (58.97)^{a}	80.00 (63.41)^{a}	80.00 (63.41)^{a}	-
T10: Uninoculated control	0.00 (0.00)^{c}	0.00 (0.00)^{f}	0.00 (0.00)^{g}	0.00 (0.00)^{g}	0.00 (0.00)^{g}	0.00 (0.00)^{g}	-
SEm($\pm$)	0.29	0.48	0.61	0.65	0.51	0.44	
CD ($P \leq 0.05$)	0.83	1.38	1.76	1.89	1.49	1.28	
CV (%)	12.75	9.23	7.2	6.98	5.17	4.43	

Mean of four replications

* Figures in parenthesis are arcsine transformed values

In the column means followed by common letter are not significantly different at 5% levell by DMRT

Date of Sowing: 23-01-2015

Date of ULCV Sap Inoculation: 02-02-2015

date of micronutrient Spraying: 03-02-2015

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