Table 2. Effect of intercropping on the incidence of the leaf spot and rust diseases of groundnut.

| Treatment | Per cent disease index Mean of two locations | |
|---|---|---|
| | Late leaf spot | Rust |
| $T_1$ | 31.55 (34.15) | 36.54 (37.13) |
| $T_2$ | 29.77 (33.04) | 33.85 (35.62) |
| $T_3$ | 32.11 (34.47) | 36.44 (37.06) |
| $T_4$ | 29.39 (32.92) | 34.94 (36.20) |
| $T_5$ | 32.30 (34.63) | 37.17 (37.53) |
| $T_6$ | 31.85 (34.35) | 36.29 (37.00) |
| $T_7$ | 34.12 (35.84) | 38.45 (38.28) |
| CD (0.05) | 2.18 | 2.20 |

Mean of three replications.
Data in parenthesis are arcsine transformed value.

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# EFFECT OF GRADED LEVELS OF POTASSIUM ON PECTINOLYTIC AND CELLULOLYTIC ENZYMES IN BLAST INFECTED LEAVES OF RICE

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ABSTRACT

The effect of increasing doses of potassium against *Pyricularia oryzae* inoculation on the production of pectinolytic and cellulolytic enzymes in inoculated leaves was studied in rice variety IR..50. The activity of protopectinase (PP), polygalacturonase (PG), poly galacturonate trans - eliminase (PGTE), Pectin trans - eliminase (PTE) and cellulases ($C_1$ and $C_x$) was found to decline due to higher levels of potassium. On the other hand, β - glucosidase activity was enhanced markedly as the rate of potassium application increased. The increased β - glucosidase activity due to increased application of potassium inhibited the lesion development, thereby resisting the entry of the pathogen into the host.

KEY WORDS : Rice blast, Potassium, Enzyme production

Rice crop suffers from a number of fungal, bacterial and viral diseases. A fungal disease, blast incited by *Pyricularia oryzae* Cav. causes severe reduction in yield upto 80 per cent (Muralidharan and Venkata Rao, 1981). It is possible to induce resistance in crop plants by balanced application of fertilisers. Application of potassium fertilizer was found to impart disease resistance (Trolldenier, 1969). Enzymes are known to be the important chemical weapons of the pathogens. Hence a potculture experiment was conducted to

study the effect of potassium application on pectinolytic and cellulolytic enzymes in pathogenesis with blast fungus.

## MATERIALS AND METHODS

Pot culture experiment was conducted in a randomized block design with four replications during Navarai (January - April) 1986 season, in leak proof cement pots of size 18" x 12" x 12". They were filled with 30 kg of clay loam soil collected from the University Experimental Farm. The rice variety IR 50 was grown in these pots. Different levels of potassium *viz.*, 0, 25, 50, 75, 100 and 125 Kg/ha were calculated on area basis and applied at two splits as muriate of potash. The nitrogen and phosphorus were also applied uniformly at the rate of 100 Kg and 50 Kg/ha to all the pots respectively. Half of the nitrogen and potassium and entire phosphorus were applied basally and the other half of nitrogen and potassium applied 25 days after transplantation. Fifty days old plants were inoculated with the pathogen by spraying the spore suspension of the pathogen. Fifteen days after inoculation, the inoculated plant leaves were collected and the mycelial growth on the surface was washed repeatedly in sterile water. The affected portions were cut into small pieces and enzymes were extracted by following the method of Sridhar *et al.* (1969). The activity of pectinolytic enzymes *viz.*, protopectinase, polygalacturonase, polygalacturonate *trans*-eliminase, pectin *trans* -eliminase was estimated by adopting the method followed by Mahadevan *et al.* (1965). The cellulolytic enzymes *viz.*, $C_1$, $C_x$ and β glucosidase were assayed by adopting the methods followed by Hussain and Dimond (1960) and Nelson (1944).

## RESULTS AND DISCUSSION

The activity of protopectinase, polygalacturonase, polygalacturonate *trans* eliminase, pectin *trans* - eliminase decreased significantly with increase in potassium levels (Table 1). Similarly, the activity of enzymes $C_1$ and $C_x$ (Cellulase) was found to decrease significantly due to rise in potassium supply. On the other hand, β glucosidase activity in inoculated plants was significantly increased as a result of higher rates of potassium application (Table 2).

**Table 1. Effect of graded levels of potassium on the *in vivo* production of pectinolytic enzymes by *Pyricularia oryzae* on IR 50 rice variety.**

| Rate of potassium application Kg/ha. | Percentage of disease Index | PP* Production | PG** Production | Percent reduction over control | PGTE@ production | Percent reduction over control | PTE@@ Production | Percent reduction over control |
|---|---|---|---|---|---|---|---|---|
| 0 | 66.80 | +++ | 23.7 | - | 14.8 | - | 13.7 | - |
| 25 | 59.30 | +++ | 20.3 | 14.35 | 12.8 | 13.61 | 11.1 | 18.98 |
| 50 | 49.40 | +++ | 17.1 | 27.85 | 10.6 | 28.38 | 9.5 | 30.66 |
| 75 | 37.22 | + | 14.7 | 37.97 | 8.1 | 45.27 | 7.3 | 46.72 |
| 100 | 29.21 | + | 11.9 | 49.79 | 7.0 | 52.70 | 5.8 | 57.66 |
| 125 | 22.42 | + | 9.0 | 63.03 | 5.8 | 60.81 | 4.9 | 64.23 |
| | S.E. | | 0.564 | | 0.679 | | 0.330 | |
| | C.D. | | 1.698 | | 1.447 | | 0.986 | |

* Maceration of potato disc; + to +++ increase in activity
** Percent loss in viscosity of 0.75% sodium polypectate at the end of 120 minutes.
@ Percent loss in viscosity of 1.2% sodium polypectate at the end of 120 minutes.
@@ Percent loss in viscosity of 1% citrus pectin at the end of 120 minutes.

**Table 2. Effect of graded levels of potassium on the *in vivo* production of cellulolytic enzymes by *Pyricularia oryzae* in IR 50 rice variety.**

| Rate of Potassium application Kg/ha. | Percentage of Disease Index | $C_1$ activity units | Per cent reduction over control | $C_x$* activity | Per cent reduction over control | β - glucosidase** activity | Per cent increase over control |
|---|---|---|---|---|---|---|---|
| 0 | 66.80 | 4.2 | - | 31.40 | - | 1.18 | - |
| 25 | 59.30 | 3.5 | 16.67 | 26.70 | 14.97 | 1.35 | 14.41 |
| 50 | 49.40 | 2.8 | 33.33 | 24.25 | 22.77 | 1.60 | 35.59 |
| 75 | 37.32 | 2.3 | 45.24 | 22.85 | 27.23 | 1.75 | 48.31 |
| 100 | 29.21 | 1.8 | 57.14 | 20.35 | 35.19 | 1.95 | 65.25 |
| 125 | 22.42 | 1.3 | 69.05 | 19.20 | 38.85 | 2.00 | 69.49 |
| | S.E. | 0.1937 | | 0.3873 | | 0.0433 | |
| | C.D. | 0.5834 | | 1.1670 | | 0.1304 | |

* Per cent loss in viscosity of 0.5% carboxymethyl cellulose (CMC) at the end of 120 minutes

** Mg of reducing sugars liberated from 1% arbutin/100 ml.

In the inoculated plants, the ability of the pathogen to produce PP, PG, PGTE and PTE and $C_1$ and $C_x$ was markedly repressed by potassium application at 25, 50, 75, 100 and 125 kg/ha. The reduction in the activity of these enzymes was marked with increase in the potassium level. The maximum inhibition on the production of all these enzymes was noticed at 125 Kg potassium/ha. The role of potassium in suppressing the activity of pectinolytc enzymes (PP, PG, PGTE and PTE) and also of $C_1$ and $C_x$ was reported by Habibullah and Prasad (1976) and Jayasekhar and Prasad (1986). Specified hydrolytic enzymes have been described to effect the cleavage of 1-4 glucosidic linkage of pectin substances. The augumentation of β - glucosidase activity due to potassium application may contribute to the increase in the phenolic levels in plants by releasing the bound phenolics from glucosides. This might play a role in building resistance in plants towards the invading pathogen(s). Similar report was also been reported by Goodman *et al.* (1967) and Jayasekhar and Prasad (1986).

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