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# Effect of Potassium Nutrition on Phenol Metabolism of Melon Wilt.

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ABSTRACT

An investigation on the role of potassium in a susceptible cultivar of muskmelon (*Cucumis melo* L.) with specific reference to the phenol metabolism indicates that K nutrition increased both total and ortho-dihydroxy phenols in the healthyones. This inference was true in the case of inoculated plants as well, with a concommitant reduction in wilt. Caffeic and ferulic ($C_6 = C_3$ phenolic) acids were observed in the plants receiving 150 and 200 kg $K_2O$/ha.

## INTRODUCTION

Evidences are accumulating on the role of mineral nutrition of muskmelon (*Cucumis meio* L.) and the fusarial wilt (*Fusarium oxysporum* f. *melonis* (Leach and Currence) Synd. and Hans. has been studied by Stoddard (1947). Wensley and McKeen (1965) obtained considerable success in reducing the wilt incidence through potassium nutrition; however, little is known about the mechanism of fusarial wilt resistance due to K nutrition. The present paper reports the phenol metabolism of muskmelons as influenced by K nutrition.

## MATERIALS AND METHODS

Finely sieved fresh sandy loam soil filled in 12" circular pots, was amended with fertilizers and moisture was adjusted to 50 per cent saturation. K (as potassium chloride) (0, 50, 100, 150, 200, 250, 300 Kg/ha) was applied together with N and $P_2O_5$ at 100 and 50 Kg/ha respectively. The pots were sterilized at 20 lb pressure for 1 hr. After cooling, oat-meal-sand culture (Rao and Rao, 1966) of the melon wilt fungus was mixed, so as to give 20 per cent (wt/wt) inoculum level. The pots were sown with surface sterilized seeds of the wilt susceptible variety (Delta Gold) of muskmelon. Wilt incidence was recorded following the method of Bhaskaran (1971) and expressed in percentage. For biochemical analysis the plant material was extracted in 80 per cent ethanol (Mahadevan *et al.*, 1965). Total phenols were estimated by employing Folin-Ciocalteu reagent (Bray and Thorpe, 1954) and Arnow's reagent (Johnson and Schaal, 1957) was used for the estimation of ortho-dihydroxy phenols.

## RESULTS AND DISCUSSION

It is evident that the percentage of wilt incidence (Table 1) is significantly

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reduced due to K application. It also caused the increase of the total phenolics and ortho-dihydroxy phenols in plants (Table 2). Increased concentration of phenolics was observed in plants receiving higher doses of K. The increase was noticed only up to 200 kg K/ha level. In general, pathogen inoculation reduced the levels of phenols; nevertheless, at higher levels of K, this reduction in total phenols was less pronounced.

TABLE 1. Effect of potassium on wilt incidence

| K* levels (kg/ha) | Per cent wilt incidence ** | | |
|---|---|---|---|
| | 15th day | 25th day | 35th day |
| 0 | — | 62 | 87 |
| 50 | — | 60 | 80 |
| 100 | — | 47 | 59 |
| 150 | — | 28 | 36 |
| 200 | — | 28 | 35 |
| 250 | — | 22 | 37 |
| 300 | — | 25 | 41 |

* K expressed as $K_2O$

** Mean of three replications

C. D. = 2.408

The building up of phenolic compounds due to $K_2O$ nourishment could be explained through their release from glucosides by the enzyme $\beta$-glucosidase (Melouk and Hornes, 1973). This is possible since the *in vitro* studies revealed that incorporation of K induced more $\beta$-glucosidase activity; also $K_2O$ increased the *in vivo* cucurbitacin (a manoglucoside) content (Ramasamy, 1974).

Potassium treatment also increased ortho-dihydroxy phenol content, which is claimed to bear a positive correlation to disease resistance (Jayapal and Mahadevan, 1968). It is well known that oxidation products of ortho phenols become highly reactive and toxic to pathogens (Mahadevan, 1970). The chromatographic studies (Table 3) displayed the occurrence of seven DSA positive spots, four of which were identified as *p*-hydroxy benzoic, vanillic, caffeic and ferulic acids. The concentration. of caffeic and ferulic acids increased in K treated (150 and 200 kg/ha) inoculated melon plants. The toxic nature of cucumber diphenols (caffeic and chlorogenic acids) to *Cladosporium cucumerinum* was reported by Mahadevan (1965) and the inhibitory nature of ferulic acid towards growth and in vitro fusaric acid production of *F. O.* f. *melonis* was recently shown by Kesavan

TABLE 2. Influence of potassium on total phenols* and ortho-dihydroxy (O. D.) phenol* in healthy and wilt fungus inoculated muskmelon

| K** levels | Particulars | 15th day | | | | 25th day | | | | 35th day | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Healthy | | Inoculated | | Healthy | | Inoculated | | Healthy | | Inoculated | |
| | | H | S | H | S | H | S | H | S | H | S | H | S |
| 0 | Total Phenols | 1.297 | 1.442 | 1.288 | 1.365 | 1.495 | 1.709 | 1.695 | 2.207 | 2.207 | 2.527 | 2.378 | 2.456 |
| | O. D. Phenols | 0.951 | 0.960 | 0.528 | 0.848 | 1.160 | 1.206 | 1.164 | 1.262 | 1.190 | 1.572 | 1.848 | 1.932 |
| 50 | Total Phenols | 1.141 | 1.228 | 1.141 | 1.141 | 1.495 | 1.997 | 1.444 | 1,956 | 2.007 | 2.375 | 1.956 | 2.227 |
| | O. D. Phenols | 0.960 | 0.960 | 0.967 | 0.992 | 1.206 | 1.298 | 1.263 | 1.391 | 1.230 | 1.992 | 1.990 | 2.172 |
| 100 | Total Phenols | 1.495 | 1.616 | 1.341 | 1.508 | 1.875 | 2.294 | 1.532 | 2.007 | 2.978 | 3.927 | 2.807 | 3.927 |
| | O. D. Phenols | 0.992 | 1.120 | 1.120 | 1.226 | 1.227 | 1.372 | 1.320 | 1.396 | 1.262 | 2.102 | 2.963 | 2.726 |
| 150 | Total Phenols | 1.875 | 1.068 | 1.508 | 2.089 | 2.820 | 3.986 | 2.532 | 2.807 | 4.523 | 5.227 | 3.756 | 4.223 |
| | O. D. Phenols | 1.160 | 1.169 | 1.322 | 1.322 | 1.298 | 1.573 | 1.360 | 1.930 | 1.327 | 2.102 | 2.292 | 2.902 |
| 200 | Total Phenols | 1.968 | 2.298 | 1.413 | 2.179 | 2.536 | 2.876 | 2.476 | 2.876 | 3.997 | 5.576 | 3.863 | 4.926 |
| | O. D. Phenols | 1.169 | 1.191 | 1.292 | 1.275 | 1.275 | 1.579 | 1.322 | 1.672 | 1.312 | 2.374 | 2.362 | 2.874 |
| 250 | Total Phenols | 1.968 | 2.007 | 1.445 | 1.958 | 2.354 | 2.876 | 2.228 | 2.776 | 4.273 | 5.227 | 3.857 | 5.103 |
| | O. D. Phenols | 0.992 | 1.206 | 1.160 | 1.275 | 1.272 | 1.997 | 1.361 | 1.957 | 1.302 | 2.478 | 2.262 | 2.702 |
| 300 | Total Phenols | 1.694 | 2.104 | 1.365 | 1.998 | 2.308 | 2.986 | 2.274 | 2.797 | 4.078 | 4.924 | 3.725 | 4.873 |
| | O. D. Phenols | 1.190 | 1.206 | 1.272 | 1.226 | 1.322 | 1.859 | 1.326 | 1.906 | 1.302 | 2.500 | 2.226 | 2.702 |

* In terms of catechol equivalent in mg/g of oven dry tissue ** K expressed as $K_2O$

H = Hypocotyl S = Shoot

(1973). $C_6 = C_3$ phenolics are lignin precursors and peroxidase undoubtedly plays a major role in oxidative polymerization of $C_6 = C_3$ phenolics to form the lignin complex (Stafford, 1974) and it is well recognised that lignification induces disease resistance in "trachemycotic" diseases. It is therefore suggested that K application augments the synthesis of phenols leading to increased disease resistance.

TABLE 3. Influence of potassium on phenols in muskmelon inoculated with wilt fungus

| Phenols | Uninoculated | K applied and inoculated (kg/ha) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0 | 50 | 100 | 150 | 200 | 250 | 300 |
| p-hydroxy benzoic acid | +++ | ++ | +++ | ++ | + | + | + | + |
| Vanillic acid | ++ | ++ | +++ | +++ | ++ | ++ | ++ | +++ |
| Caffeic acid | + | + | ++ | ++ | +++ | +++ | ++ | ++ |
| Ferulic acid | +++ | + | ++ | ++ | +++ | +++ | ++ | ++ |
| Unidentified Compounds | | | | | | | | |
| I Rf 0.89 | — | — | + | ++ | +++ | ++ | ++ | ++ |
| II Rf 0.51 | — | ++ | ++ | ++ | + | ++ | — | + |
| III Rf 0.44 | ++ | +++ | ++ | + | + | ++ | ++ | — |

+ to +++ Intensities of the colour of the chromatogram spot in increasing order, — absent.

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