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A Note on the Response of Three Onion *(Allium cepa* L.) Cultivars to Infection with VAM-fungi and Onion Yellow Dwarf Virus (OYDV)

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Abstract: Onion is one of the most important vegetables in the Sudan. The main onion growing areas, in the country, particularly in Khartoum and River Nile States, are seriously affected by a widespread onion yellow dwarf potyvirus (OYDV). It causes substantial reductions in both bulb and seed yields. Application of biofertilizets, such as vesicular arbuscular mycorrhizal (VAM) fungi, has been reported to improve plant growth and productivity (Mirghani and Elsheikh 1996). Thus, the VAM fungus was tested as an integrated pest management (IPM) component that might alleviate the destructive effect of OYDV by improving plant growth.

Onion seedlings of cvs. "Saggai" (local red), "Dongola" (local yellow) and “Texas Early Grano 502” (imported yellow) were grown in pots (20 cm in diam.) containing 2.4 kg un-sterilized clay soil. VAM strain was isolated using the Wet Sieving and Decanting Technique, and the inoeulation was carried out according to Mirghani and Elsheikh (1996). OYDV was sap-transmitted where required, as previously described by EI Hassan and Morgan (1992). For each cultivar, the following four treatments were designed and replicated three times:

1. Onion seedlings inoculated with VAM strains.
2. Onion seedlings inocualted with OYDV.
3. Onion seedlings inoculated with both VAM and OYDV.
4. Onion seedlings untreated (control).

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The pots, in triplicate, were arranged using the completely randomized design' and were irrigated every two days. Plants were harvested I8-weeks after transplanting. Bladed leaves number, leaf length, leaf width, shoot and root dry weights, VAM infection percentage, bulb size, shoot phosphorus content and total soluble solids (TSS) were determined.

Infection with OYDV significantly reduced leaf length, leaf width, shoot and root dry weights, bulb size and shoot P content of the local cultivar, namely, "Saggai" and "Dongola" (Table I), while the introduced cv. “Texas Early Grano” showed only very mild symptoms. The visual symptoms on the susceptible cultivars were observed two weeks after inoculation. The typical symptoms of the virus were general yellowing, streaking, flaccidity, curling and lop over of leaves loosing their turgidity (EI Hassan and Morgan 1992). The viral damage may result from the abnormal metabolism that is caused by the virus infection in the host's tissues. The general chlorosis or yellow streaks may be due to the reduction in chlorophyll production and the break down of chloroplasts.

The VAM inoculation significantly increased the mycorrhizal infection percentage of the three cultivars (Table I). The VAM inoculation also significantly improved some of the growth, yield and quality of cv. "Dongola" such as shoot dry weight, bulb size, total soluble solids and shoot P content compared with the control plants. In mixed infection with OYDV, VAM caused pronounced enhancement in these components over the virus-infected onion plants (Table 1). Similarly, cv. "Saggai" infected with OYDV responded significantly to VAM inoculation. Although cv. “Texas Early Grano” was successfully infected by the VAM fungus, it did not benefit from this interaction in the presence or absence. of O YDV infection (Table 1). The differential response of these oniqn cultivars to VAM fungus infected could be due to physiological, anatomical and biochemical reasons such as substances secreted by the cultivar roots e.g. yellow pigments, chitin ant sterols (Schmitz *et al*. 1991).

Table 1. Effect of vesicular-arbuscular mycorrhizal (VAM) fungus and OYDV on onion (*Allium cepal* L.) cultivars "Saggai" "Dongola" and "Texas Early Grano 502" harvested 18 – weeks from transplanting.

Treatment	Leaf length (cm)	Leaf width (cm)	Leaf number	VAM Infection %	Shoot dry weight (g)	Root dry weight (g)	Bulb size - (cm)	Total soluble solids[I]	Shoot P content (mg P/g weight
cv. Saggai									
Control	42.0a[2]	1.0a	2.8a	34.lb	2.5a	1.0a	1.5a	20.2a	2.0a
VAM	41.0a	0.9a	2.8a	60.6a	2.6a	1.0a	1.6a	19.4a	2.1a
VAM+OYDV	34.0b	0.6b	2.7a	56.8a	1.6b	0.5b	0.9b	19.7a	2.8a
OYDV	30.0c	0.6b	2.8a	36.0b	1.1c	0.3c	0.6c	16.4b	1.9b
S.E±	3.188	0.086	0.139	6.421	0.419	0.134	0.315	0.699	0.706
cv. Dongola									
Control	42.8a	0.9a	2.9a	2.9b	1.5b	0.4ab	1.2b	12.9b	3.9b
VAM	43.5a	0.9a	3.la	3.la	1.9a	0.5a	1.5a	14.la	4.9a
VAM+OYDV	38.6ab	0.7b	2.7a	2.7a	1.1c	0.3b	0.8c	12.0c	2.9c
OYDV	38.0b	0.7b	2.7a	2.7b	0.7d	0.2c	0.7c	11.5c	2.1d
S.E±	4.057	0.118	0.159	0.159	0.352	0.126	0.170	0.590	0.821
cv. Texas									
Control	38.3a	1.0a	3.0a	3.0b	5.6a	0.2a	3.9a	15.7a	9.0a
VAM	47.0a	0.9a	3.la	3.la	5.6a	0.2a	4.0a	16.4a	9.1a
VAM+OYDV	36.7a	0.8a	3.1a	3.la	6.0a	0.2a	4.0a	16.7a	9.2a
OYDV	45.3a	1.1 a	3.la	3.lb	5.3a	0.2a	3.8a	16.3a	8.3a
S.E±	9.400	0.333	0.186	8.269	1.102	0.120	0.719	1.115	1.375

[1] Data of VAM infection percentage and total soluble solids are transformed data.
[2] Figures followed by same letter(s) in a column are not' significantly different.

The VAM fungus not only improved growth and quality of cvs. "Dongola" and "Saggai", but also reduced the harmful effect of the virus, although the response and the viral infection differed with the onion cultivar. It is, therefore, envisaged that VAM-fungi as biofertilizer could have a promising perspective as an important component in the integrated pest management programme of onion yellow dwarf disease by selecting suitable VAM strains with suitable onion cultivars.

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