

Estimation of Yield Loss Caused by Groundnut Ring Mosaic Disease

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The susceptibility of groundnut plants to ring mosaic virus decreased with increase in age and the plant susceptibility was negatively correlated with yield. Adverse effects on plant height, shoot weight, root nodules, pegs formed, pod weight and kernel weight of groundnut plants infected at 1, 2, 4, 6 and 8 weeks of age were determined.

The importance of plant diseases is recognised by the extent of yield loss caused by them. The magnitude of loss in yield due to plant diseases depends on various factors, the important ones among them being the age of plants at infection, local or systemic infection and type of tissues affected. The loss of groundnut caused by rosette and mosaic diseases was assessed by Kousalya *et al.* (1967, 1970). With a view to determining the yield loss induced by groundnut ring mosaic disease which has been noticed in several districts of Tamil Nadu (Narayanasamy *et al.*, 1975), the present study was taken up and the results are presented in this paper.

MATERIALS AND METHODS

The POL 1 groundnut (*Arachis hypogaea* L.) plants were raised in pots under glasshouse conditions. Different sets of plants were inoculated by single-leaf graft technique at 1, 2, 4, 6 and 8 weeks after sowing. Suitable uninoculated control plants were maintained. The observations on incub-

ation period of the groundnut ring mosaic virus, number of plants infected, epigeal and hypogeal plant characters and attributes contributing towards yield were made.

RESULTS AND DISCUSSION

The susceptibility of plants to virus infection has been reported to decrease as the plants advance in age (Ling and Palomar, 1976; Palomar and Ling, 1968; Narayanasamy, 1972; Narayanasamy and Jaganathan, 1975). In the case of groundnut, similar progressive reduction in susceptibility to groundnut ring mosaic virus with increase in age of plants at infection was observed (Table I). The incubation period in the inoculated plants showed an increase as the plants become older. This finding also is in line with earlier observations of Narayanasamy and Jaganathan (1975) who reported a positive correlation between the age of black gram plants at inoculation and incubation period of blackgram leaf crinkle virus in the plants. The high susceptibility of young groundnut plants

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TABLE I. Influence of age of plants at inoculation on the susceptibility to and incubation period of groundnut ring mosaic virus (GRMV).

Age of plants at inoculation (weeks)	No. of plants infected/inoculated	Percentage of infection	Incubation period (days) Range	Mean
1	20/24	83.33	8-25	17
2	16/25	64.00	12-30	21
4	15/25	60.00	14-34	24
6	12/25	48.00	17-36	27
8	10/24	41.66	18-40	29

and short incubation period required for the virus in such plants culminated in the thorough distribution of the virus in young plants causing maximum adverse effects on growth and yield of infected plants.

The groundnut plants infected at one week of age exhibited maximum reduction in height (56.09 per cent) when compared to healthy plants (Table II). There was a progressive decrease in the adverse effect on plant height as the age of the plants at infection increased. There was no marked change in height of plants infected 6 and 8 weeks after sowing and it was on par with healthy plants. The possibility of using reduction in the height of black gram as a parameter to assess the yield loss due to virus infection was indicated by Narayanasamy and Jagathan (1974). But in groundnut ring mosaic virus-infected plants no correlation between height of plants and yield was observed. There was significant increase in the number of nodes in plants infected up to 4 weeks after

TABLE II. Effect of GRMV on epigeal plant characters

Age of plants at inoculation (weeks)	Height of plants (cm)	No. of nodes
1	11.9	16.4
2	18.1	17.6
4	22.5	16.4
6	30.1	14.0
8	28.1	13.0
Control (uninoculated)	27.1	13.2
C.D. (P=0.1)	4.0	2.4
	Shoot Weight Fresh (g)	Shoot Weight Dry (g)
1	6.26	1.230
2	6.42	1.407
4	11.60	2.604
6	12.24	2.774
8	9.16	2.035
Control (uninoculated)	25.56	4.986
C.D. (P=0.01)	4.5	0.75

sowing. Reduction in internodal length and crowding of leaves at the apex was observable in such plants. Marked and statistically significant reduction in fresh and dry weight of shoot in young infected plants were indicative of considerable growth retardation in such plants.

The effect of groundnut ring mosaic virus infection on the hypogeal plant characters that may influence the yield of plants were also studied. There was no significant variation in the root length of plants infected at different periods of inoculation. However, the data on the dry weight of roots of plants infected at different periods after sowing showed the poor development of root system in plants infected in the early stages of growth (Table III). The adverse effect on root formation could

be expected to induce definite reduction in the absorption of nutrition and consequently the yield. There was complete absence of root nodules in plants infected 1 and 2 weeks of age. There was no significant variation in the number of nodules formed in plants infected 4, 6 and 8 weeks after sowing, when compared to control. However, the weight of nodules showed significant differences. Over 50 per cent reduction in the weight of root nodules was discernible even when the plants were infected at 8 weeks of age (Table III). The adverse effects of virus diseases on root nodules of legumes have been reported by many workers (John, 1959;

Kousalya *et al.*, 1967; Narayanasamy and Jaganathan, 1974).

Regarding the characters that have direct bearing on yield of groundnut plants, different magnitude of adverse effects were noticed, depending on the age of plants at infection. Early infection of groundnut plants by ring mosaic virus caused total loss as there was no peg and pod formation. As the age of plants at infection increased there was increase in the number of pegs and pods formed and weight of pods and kernels (Table IV). There was no significant difference in the mean kernel weight of plants infected at 4, 6 and 8 weeks after sowing. The loss induced by groundnut ring

TABLE III. Effect of GRMV on hypogeal plant characters

Age of plants at inoculation (week)	Root length (cm)	Root weight Dry (mg)
1	14.3	178.8
2	22.6	237.4
4	18.3	536.0
6	21.6	429.6
8	25.6	383.8
Control (uninoculated)	30.9	796.8
C. D. (P=0.01)	N.S.	180.3
Age of plants at inoculation (week)	No. of root nodules	Weight of nodules (mg)
1	0	0
2	0	0
4	4.2	0.0122
6	2.4	0.0086
8	6.0	0.0358
Control (uninoculated)	11.4	0.0778
C. D. (P=0.05)	N.S.	0.0586

N. S. — Not significant

TABLE IV. Effect of GRMV on yield attributes

Age of plants at inoculation (week)	No. of pegs formed	No. of pods
1	0	0
2	0	0
4	5.4 (2.207) ^a	1.8 (1.287) ^a
6	7.4 (2.658)	4.4 (2.077)
8	8.6 (2.895)	3.6 (1.875)
Control (uninoculated)	11.8 (3.409)	7.6 (2.740)
C. D. (P=0.01)	0.755	0.502
Age of plants at inoculation (week)	Weight of pods (g)	Weight of Kernels (g)
1	0	0
2	0	0
4	0.4912	0.2350
6	1.4526	0.8690
8	1.4802	0.9586
Control (uninoculated)	5.7420	4.2968
C. D. (P=0.01)	0.949	0.816

^a Transformed values ($\sqrt{\frac{1}{1+x}}$ transformation) are given in parentheses

mosaic virus ranged from 77.69 to 100 per cent based on kernel weight, depending on the age of plants at the time of infection. Since the plant susceptibility decreased with increase in age and the kernel weight increased with increase in age at infection, the linear relationship between these two factors was worked out. The susceptibility of groundnut plants was negatively correlated with kernel weight ($r = 0.94$) and the data were fitted in the regression equation $Y = 3.7825 - 0.055X$. As groundnut is rightly called as unpredictable legume, no single vegetative character of the infected plant appeared to be correlated with yield. It is considered that the intense growth retardation brought about by early infection had pronounced adverse effect on yield components resulting in total loss or insignificant yield of the infected plants.

REFERENCES

- JOHN, V.T. 1959. Root and nodule development in *Dolichos lab lab* L. infected with *Dolichos enation mosaic virus*. *Curr. Sci.* 28: 24.
- KOUSALYA, G., R. AYYAVOO, and C. S. KRISHNAMURTHY. 1970. Effect of mosaic disease on groundnut. *Madras agric. J.* 57: 396-9.
- KOUSALYA, G., S. BHASKARAN and C. S. KRISHNAMURTHY. 1967. Assessment of crop loss caused by rosette disease of groundnut. *Indian J. agric. Sci.* 37: 356-61.
- LING, K. C. and M. K. PALOMAR. 1967. Studies on rice plants infected with the tungro virus at different stages. *Philippine Agric.* 50: 166-77.
- NARAYANASAMY, P. 1972. Influence of age of rice plants at the time of inoculation on the recovery of tungro virus by *Nephotettix impicticeps* (Ishihara). *Phytopath. Z.* 74: 109-14.
- NARAYANASAMY, P. and T. JAGANATHAN. 1974. Effects of virus infection on the yield components of black gram. *Madras agric. J.* 61. 451-6.
- NARAYANASAMY, P. and T. JAGANATHAN. 1975. Seed transmission of black gram leaf crinkle virus. *Phytopath. Z.* 82: 107-10.
- NARAYANASAMY, P., T. K. KANDASWAMY and M. RAMIAH. 1975. A new virus disease of groundnut in Tamil Nadu. *Madras agric. J.* 62: 371-5.
- PALOMAR, M. K. and K. C. LING. 1968. Yield losses due to grassy stunt infection. *Philippine Phytopath.* 4: 14.