Table 1. Effect of shade on growth and seed yield of amaranthus as intercrop under banana

Treatment (%)	Light available to amaranthus (%)	Light intercepted by amaranthus (%)	Plant height at harvest (cm)	Spike length/ plant at harvest (cm)	Seed yield/ plant (g)
T1	100.00	51.14	135.71	12.63	22.80
T2	62.70	22.80	73.33	8.14	5.10
T3	28.72	12.03	32.86	3.03	2.90
CD (0.05)			8.54	1.75	6.49

MATERIALS AND METHODS

The experiment was laid out in randomised block design with the popular leaf amaranthus var. *Kannara local* (*Amaranthus tricolor*) during the year 1990-91. Plants were grown as intercrop under banana var. *palayankodan* of different growth stage. They were receiving different intensity of light which was measured by a LI-190SB quantom sensor at flowering stage of amaranth. The treatments included amaranthus grown in open area (T1), amaranthus grown under banana var. *palayankodan* of 4 month age (T2) and amaranthus grown under banana var. *palayankodan* of 8 month age (T3). The treatments were replicated seven times. After attaining proper maturity, the plants along with the spikes were harvested, dried and the seeds were removed and cleaned. Observations on plant height, spike length and seed yield/plant were recorded and analysed.

RESULTS AND DISCUSSION

Results indicated that shading reduced the growth and seed yield of amaranthus (Table 1). Significant difference were observed for the plant height, spike length and seed yield/plant under different intensities of light. In open condition (T1), plant height, spike length and seed yield were maximum and these characters showed a decreasing trend with increase in shade. Height of the plant at the time of harvest was decreased from 135.71cm (T1) to 32.86 cm (T3). Similarly length of spike at harvest significantly decreased from 12.63cm to 3.03cm and seed yield/plant from 22.8g to 2.90g. Similar reduction in growth and yield has been reported in the case of some rainfed vegetable intercrops of coconut (Krishnankutty, 1983).

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HEAVY METALS, GROWTH REGULATORS AND VITAMINS REQUIREMENTS OF *Phoma sorghina*

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ABSTRACT

Phoma sorghina grew poorly in liquid basal medium without the addition of heavy metals, growth regulators and vitamins. Among trace elements, iron and among growth regulators, Indol- 3 yl- Butyric acid, Indol-3 yl- Acetic acid and 2-Naphthoxy acetic acid were toxic to the fungus as their omission from medium supported good growth while presence of all the vitamins tried supported better growth of fungus.

Phoma sorghina(Sacc.) Boerema, Dorenb. & Kest. causing black dots on sorghum grains in Rajasthan (Rathore *et al.*, 1983) was studied with regards to its requirements of heavy metals, growth regulators and vitamins.

MATERIALS AND METHODS

The pathogen causing black dots of sorghum grains was isolated by adopting blotter technique. For isolation, 500 infected seeds were used. The culture was purified by repeated subculturing and

Table 1. Average dry mycelial weight of *Phoma sorghina* in modified Richard's medium supplemented and omitted with different trace elements, growth regulators and vitamins after 5 days of incubation at 28 ± 1°C and pH 6.7

Trace element omitted from modified basal medium	Average dry mycelial weight (mg)*	Growth regulator omitted from modified basal medium	Average dry mycelial weight (mg)*	Vitamin omitted from modified basal medium	Average dry mycelial weight (mg)*
Iron	637.0	Indol-3yl-butyric acid	652.2	All vitamins present (control)	839.5
All trace elements present (control)	629.5	Indol-3yl-acetic acid	642.0	Thiamine	821.5
Zinc	603.5	Naphthyl acetic acid	619.5	Folic acid	793.2
Molybdenum	591.7	All growth regulators present (control)	589.5	Calcium pantothenate	775.7
Copper	565.7	2-Naphthoxy acetic acid	567.7	Biotin	774.5
Calcium	550.7	2,4-dichlorophenoxy acetic acid	560.0	Riboflavin	764.2
Magnesium	529.7	Indol-3yl-propionic acid	485.5	Nicotinic acid	763.5
Manganese	517.0	Gibberellic acid	442.0	Ascorbic acid	723.7
Boron	491.5	All growth regulators omitted	357.7	B-carotine	709.0
All trace elements omitted	346.5			Kinetin	617.2
				Pyridoxine	599.7
				Cyano-cobalamin	591.0
				All vitamins omitted	448.2
SEm ±	0.6645		0.9192		0.8056
CD at 5%	1.9191		2.6674		2.3036

* Average of four replications

monoconidial isolate of the fungus was obtained by single spore isolation. The pure culture thus obtained, was maintained on Potato Dextrose Agar (PDA). For the study of trace elements, the modified Richards liquid medium in which dextrin and ammonium chloride were used as carbon and nitrogen source respectively and devoid of MgSo4 and Fe Cl_2 was purified for heavy metals already present in the medium as contaminants, by the method of Steinberg (1935). For the study of growth regulators and vitamins, the modified basal medium was purified against impurities of growth regulators and vitamins by treating it with activated charcoal. The experiments were done by omission method *i.e.* each treatment contained all the heavy metals/growth regulators/vitamins under study except one, to see the effect of the missing heavy metal/growth regulator/vitamin on the fungal growth in the respective studies. All the trace elements, growth regulators and vitamins under study were used at the concentration of 10 ppm.

In the present investigation, the monoconidial culture of the fungus was subcultured twice for 10 days in the liquid basal medium. The mycelium obtained was used to prepare a standardized inoculum suspension (400 mycelial bits/ml). One ml of the above suspension (after removing the lag effect) was added to 20 ml of the autoclaved medium in 100 ml conical flask and kept at 20 ± 1^0 C. Each treatment was replicated four times. Dry mycelial yield in mg for each treatment was estimated after five days incubation and analysed statistically.

RESULTS AND DISCUSSION

Trace elements

The minimum or maximum concentrations of trace elements required for supporting good growth varies with different fungi. It is clear (Table 1) that in the presence of all the trace elements tested, good growth was recorded; but maximum growth of the fungus was obtained when iron was omitted. It shows that the presence of iron along with other trace elements is inhibitory on the growth of the fungus. Reduction in growth was observed in the increasing order, when zinc, molybdenum, copper, calcium, magnesium and manganese were omitted singly from the basal medium, respectively. However, growth was very much reduced, when boron was omitted from the basal medium, which

shows that the presence of these elements in the medium influences the physiology of the pathogen and appear to enhance the growth rate. Similar results were recorded by Verona and DeMarchi (1939) who reported that a minute quantity of boric acid exert a stimulatory action on the development of *Phoma betae*.

Growth regulator

It is obvious (Table 1) that when Indol-3 yl butyric acid (IBA), Indol-3yl-acetic acid (IAA) and Alpha naphthyl acetic acid (NAA) were omitted, the growth of the fungus was superior than the presence of all the growth regulators. It shows that in the presence of IBA, IAA and alpha-NAA there might be some inhibitory action on the growth of the fungus. The omission of 2-Naphthoxy acetic acid (2- NAA) and 2,4-dichlorophenoxy acetic acid (2,4-D) from the medium gave fair growth. However, poor growth was observed by omission of Indol-3yl-propionic acid (IPA) and gibberellic acid(GA). It indicates that IPA and GA play an important role among all the growth regulators tested to increase the growth of the pathogen.

Vitamin

It is evident (Table 1) that fungus yielded maximum growth in the presence of all vitamins and minimum growth in the absence of all vitamins. Omission of thiamine, folic acid, calcium pantothenate and biotin gave good growth of the pathogen. It indicates that the growth of the fungus is not influenced much by the absence of these vitamins in the medium. The growth was fair by omission of riboflavin, ascorbic acid, nicotinic acid and B-carotine. However, the growth was affected greatly by omission of minetin, pyridoxine and cyanocabalamine, which shows that these three vitamins are more responsible for the growth of the fungus than the other vitamins. The results are in conformity with those of Misra and Mahmood (1961) who reported stimulated mycelial growth due to cyanocobalamine in *Colletotrichum* capsici.

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DRIP IRRIGATION IN ANNUAL MORINGA

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ABSTRACT

An experiment was conducted to study the performance of drip method of irrigation in annual moringa. The results revealed that the highest water use efficiency (30.58 kg/m^3/ha) was achieved through drip irrigation with 4 l/day/tree.

Drip irrigation is one of the modern methods of irrigation. At Rahuri, Maharastra State, it was observed that there was a substantial water saving in drip irrigation ranging from 40 to 70 per cent in different crops (Anon, 1991). Annual moringa is a vegetable crop which can be harvested from 6 months and upto 14 months. Even then, cutting back the trees to 90 cm height, from ground level after the last harvest, ratoon crop will be coming for harvest in another 4 to 5 months and this type of ratoon cropping can be taken for 3 to 4 crops. The present study was carried out with the objective to study the performance of drip irrigation and the water use efficiency (WUE) of annual moringa.

MATERIALS AND METHODS

The experiment was conducted at the Agricultural Research Station, Bhavanisagar in sandy loam soils. The details of the treatments were as follows: