medium (Nene and Sheila 1994). Our studies indicate that granulated tapioca can be used instead of agar to detect seedborne infection by *Aspergillus* spp.

Tapioca-based media can be used to isolate fungi and bacteria, and for the maintenance and short-term preservation of fungal cultures (Nene and Sheila 1994). The media can also be used in seed pathology studies. Attempts are being made to use granulated tapioca instead of agar in tissue culture media for callus induction in grain legumes.

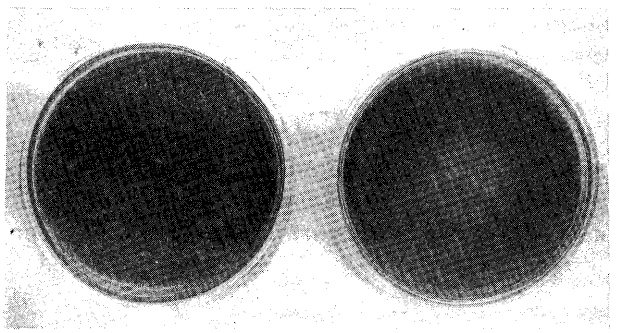

Figure 1. Growth of *Rhizoctonia bataticola* after 4 days on chickpea-dextrose-tapioca (left) and potato-dextrose-agar (right).

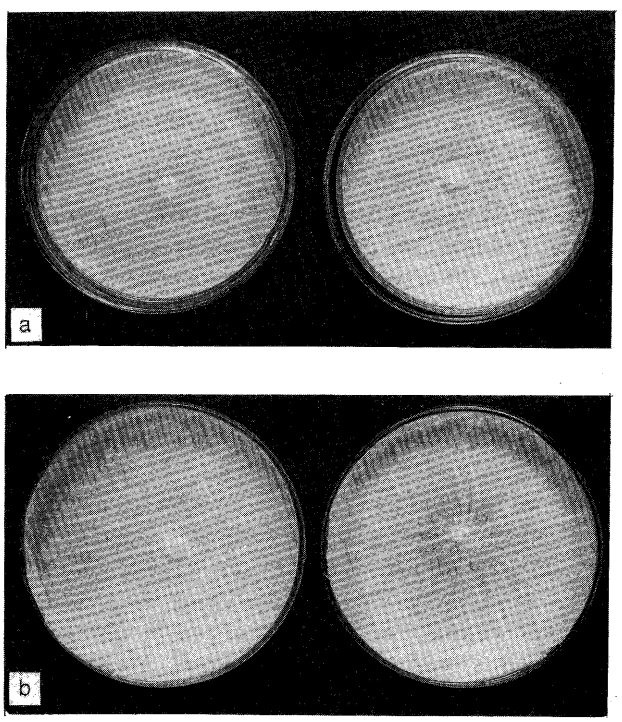

Figure 2. Growth of *Sclerotium rolfsii* after 4 days on: (a) chickpea-dextrose-tapioca (left) and potato-dextrose-agar (PDA) (right); and (b) potato-dextrose tapioca (right) and PDA (left).

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Survey of Groundnut Diseases in Northern Malawi

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Groundnut is the most important leguminous crop grown in Malawi. In the smallholder sector, groundnut is the second most important crop after maize, and provides a supplementary source of income. Until recently, groundnut was Malawi's fourth most important export crop after tobacco, tea, and sugar. However, yields are very low, averaging 700 kg ha^{-1} (unshelled). Diseases are a major constraint to groundnut production in Malawi.

In collaboration with the Malawi Ministry of Agriculture, a survey was carried out in Apr 1993 to assess the distribution and relative importance of various groundnut diseases in farmers' fields in Mzuzu and Karonga Agricultural Development Divisions (ADDs) of northern Malawi. A total of 54 groundnut fields were surveyed (Fig. 1).

Mzuzu ADD. In Mzuzu ADD, 34 groundnut fields were visited—14 fields in the central and southern areas of Mzimba (Chasula, Kamatawo, Chafisi, Embangweni, Mbawa, Chitaya, Njebwa, Chimutu, Chiswa, Mathandani, Eswazini, and Emoneni); 17 in the Rumphi and northern Mzimba areas (Njakwa, Gumbo, Ruviri, Kamphenda, Kazuni, Mpherembe, and Malidade); and 3 fields in the Nkhata Bay area. Most of the fields were sown late in these areas. Plant population was low in many fields. The majority of the fields surveyed were sown to a mixture of varieties Chalimbana, Kalisere, and Mwitunde. A number of fields surveyed around the Ruviri area were sown to a mixture of Malimba (locally known as Kasawaya) and an unknown red-seeded valencia type. In the Nkhata Bay area, most of the fields surveyed were sown to Malimba.

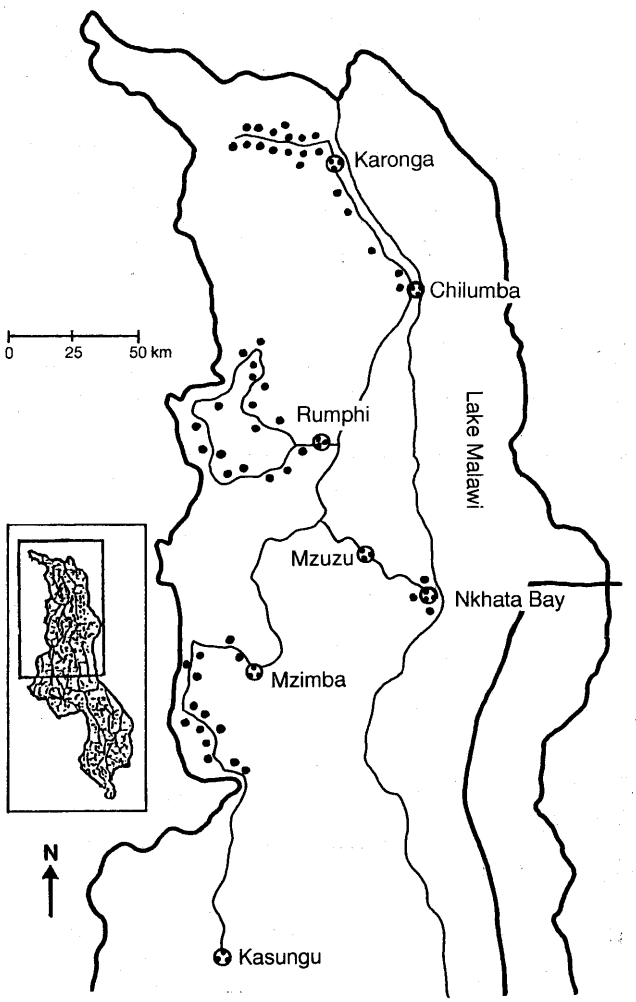

Figure 1. Areas in Malawi surveyed for groundnut diseases.

Early leaf spot (*Cercospora arachidicola*), late leaf spot (*Phaeoisariopsis personata*), and rust (*Puccinia arachidis*) were very common. However, late leaf spot and rust were particularly severe, causing extensive damage to the crop. Early leaf spot was serious only in the Ruviri and Mpherembe areas. *Darluca* sp was commonly found associated with groundnut rust pustules in fields near Chitaya. Groundnut rosette (chlorotic form) was observed in almost all fields, but the incidence was surprisingly low in spite of late sowing and poor plant stand in several fields. The average incidence of groundnut rosette in this ADD was about 3%. Other diseases recorded were leaf scorch (*Leptosphaerulina crassiasca*), web blotch (*Phoma arachidicola*), phyllosticta leaf spot (*Phyllosticta arachidis-hypogaea*), anthracnose (*Colletotrichum* sp), and groundnut streak necrosis disease (sunflower yellow blotch virus). However, the severity of these diseases was low, and they did not appear to cause any appreciable damage to the crop. Plants showing symptoms of witches' broom (bushy plants with reduced leaf size and pegs showing negative geotropism) were observed in several fields, but disease incidence was negligible. Witchweed (*Alectra vogelii*) was observed in almost all fields surveyed in Mzuzu ADD, but again the incidence was negligible.

Karonga ADD. In Karonga ADD, the survey was limited to the Karonga Rural Development Project. In this area, 20 groundnut fields around Majiga, Chikangawa, Lupembe, Katili, Baka, Malungo, Gwepe, Mwenitanga, and Nthora were surveyed. Crop management in these areas was very good. Malimba was the most common variety in these areas. Although some late-sown fields were noticed, most fields had been sown in time (early Dec 1992). This was evident from the fact that some farmers were already harvesting their crop.

The disease spectrum in Karonga ADD was similar to that in Mzuzu ADD. Late leaf spot and rust were the most important diseases; in many fields only withered stems were observed due to severe attack by these diseases. Groundnut rosette was observed for the first time in the Malungo, Gwepe, Mwenitanga, and Nthora areas of Karonga ADD.

Conclusions. Groundnut is an important crop in Mzuzu and Karonga ADDs. Late leaf spot and rust were the most predominant and destructive groundnut diseases in these areas, and the introduction of genotypes with resistance to these diseases should prove useful in northern Malawi. Groundnut rosette was observed for the first time in Karonga ADD.

Toward Standardization of a Laboratory Screening Technique for Early Leaf Spot Resistance in Groundnut

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Field screening for early leaf spot resistance in groundnut is not always successful because of fluctuations in weather conditions over seasons. Recent research (Butler et al. 1994) has indicated that duration of leaf wetness and temperature are important factors in disease development. The detached leaf culture technique developed by Melouk and Banks (1978) has many advantages, but the disease reactions may not always correspond with those shown on leaves still attached to plants. A laboratory screening technique was therefore developed, using whole plants held in a dew/growth chamber. We present the results of investigations on the effect of inoculum concentration on the efficiency of such a screening system using cultivars with varying levels of resistance to *Cercospora arachidicola*.

Plant material. Three genotypes (ICGs 9294, 10920, and 7892) with varying levels of resistance to early leaf spot and two susceptible genotypes (J 11 and TMV 2) were used in this study. Four seeds of each genotype were sown in each of twelve 15 cm diameter plastic pots containing autoclaved Alfisol and farmyard manure (4:1 ratio) in a greenhouse. Two plants were retained in each pot after germination. The temperature of the greenhouse was maintained at 25–30°C. The experiment was arranged in a randomized block design with four replications for each conidial concentration. Two fully opened quadrifoliate leaves (third and fourth from top) on each plant were inoculated when the plants were 30 days old.

Preparation of inoculum. Conidia were collected from sporulating lesions on the susceptible cultivar TMV 2 using a cyclone spore collector, and stored in small glass vials held at 4°C. Conidial inoculum was prepared

Table 1. Reaction of three known early leaf spot resistant and two susceptible groundnut genotypes 30 days after inoculation with the ICRISAT isolate of *Cercospora arachidicola* in dew/growth chamber, ICRISAT Asia Center, 1993/94.

	Number of lesions cm^{-2} leaf			Lesion diameter (mm)			Number of conidia per lesion			Percentage leaf area damaged			Percentage defoliation		
Genotype	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Resistant															
ICG 7892	0.05	0.22	0.55	2.9	3.1	2.6	1250	1350	1100	0.8	2.3	4.3	2	19	41
ICG 9294	0.10	0.80	1.73	4.8	4.2	3.2	1300	1300	1400	4.0	10.9	17.2	2	45	72
ICG 10920	0.10	0.70	1.27	4.9	5.0	4.1	1550	1463	1525	1.5	11.0	14.6	0	19	49
Susceptible															
J 11	0.18	0.60	1.22	7.0	6.6	4.5	5000	5300	5300	2.3	9.4	15.8	6	45	72
TMV 2	0.10	0.49	1.26	5.7	5.6	4.3	3250	2800	3000	1.2	5.0	13.1	11	49	83
	SE	LSD		SE	LSD		SE	LSD		SE	LSD		SE	LSD	
Concentration × Genotype	±0.15	0.42		±0.3	0.85		±42.5	1215		±1.4	4.0		±8.3	23.7	
CV (%)	46.4			13.6			32.8			39.0			47.7		

T1 = 100 conidia per mL of inoculum, T2 = 500 conidia per mL of inoculum, T3 = 1000 conidia per mL of inoculum.
All LSDs at 5% probability level.