Results. Based on these results, two breeding approaches were developed:

1. A short-term program consisting of backcrosses for (i) transfering earliness from Chico, which matures in 75 days, to cv 73-30 and 55-437, both 90-days long; (ii) transfering the character "small seed" from 55-437 to 57-422, in which favorable physiological traits for adaptation to drought had previously been found.

This program resulted in a pre-release of an 80-day variety, GC8-35, for the northern region. Production was about 20% more than that of the area control, 55-437. This variety also performed well in Brazil. In the case of the transfer of seed character, the program was advanced until the fifth backcross. Twenty-four original stable lines resulting from a genealogical selection from the previous backcrosses are available for statistical evaluation.

2. A long-term recurrent selection program for the north-central part of the basin is in progress. Recurrent selection is the only available breeding method which allows the combination, in the same genotype, of multiple favorable alleles dispersed in numerous lines. In addition, it enables us to generate new variability by creating a genetically broad population from diverse genetic sources. The population is subjected to continuous intrapopulation improvement. Each selection cycle involves manually intercrossing about 40 to 50 S3 segregating lines previously selected according to a double process: field evaluation for production characters, and laboratory screening for physiological criteria.

The first two cycles of selection showed significant progress compared to the original population. The third cycle of selection will be completed in 1997. Advanced breeding lines were developed using genealogical selection from the first population in Senegal, Burkina Faso, Botswana, and Brazil. These lines, which are at least as productive as the control, are now available for multilocational evaluation in these four countries.

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Pathology

Occurrence of Groundnut Aphids (*Aphis craccivora* Koch) and Rosette Disease in Irrigated Dry Season Groundnut in Central Malawi

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Aphis craccivora Koch causes damage to groundnut by sucking plant sap and transmitting a number of virus diseases including rosette (Reddy 1991). Currently rosette is considered to be one of the most serious diseases of groundnut in sub-Saharan Africa. The seasonal and regional variations in rosette incidence are not fully understood. It is not known if the seasonal carry-over of rosette depends primarily on groundnut itself or on alternative hosts. While rosette occurs sporadically wherever groundnut is cultivated in the semi-arid tropics of sub-Saharan Africa, reports in the literature indicate that rosette outbreaks are more common in areas with bimodal rainfall and double cropping (Evans 1954, Harkness 1977), suggesting that groundnut plays a major role in the disease cycle. We also have observed high incidence of rosette (>50%) in groundnut farms in Karonga, Northern Malawi, where groundnut is cultivated throughout the year (P Subrahmanyam, unpublished data). However, the role of indigenous hosts of rosette as primary source of inoculum is yet to be determined (Hildebrand et al. 1991).

The occurrence of aphids and rosette in groundnut bait plots in Central Malawi, an area with monomodal rainfall and an extended dry season, was studied during the 1996 dry season. The preceding wet season saw high rosette incidence in this area. It was assumed that if alternative hosts for rosette existed in the region, they would act as a source of inoculum for transmitting rosette to groundnut bait plots sown in the dry season. We collaborated with vegetable growers in "dambo" areas (moist valleys with waterlogging) in a 30-km radius around Chitedze, Central Malawi. Thirty-seven plots in five villages, were sown with Malimba, a short-duration cultivar, during the last week of Aug 1996. Groundnut was sown at 30 × 30 cm in raised beds in an area of 100 m^2 per farm, in soil varying from heavy black clay to light sandy loams. The plots were irrigated with well water. Pesticides were not applied. Populations of *A. craccivora* and incidence of rosette were recorded until the end of dry season. Aphids were first noticed during the last week of Oct (about 2 months after sowing), in 29 % of the fields. The crop was in the flowering stage. However, the canopy was not fully covered. Aphid infestation ranged from 6 to 32%, and on each plant the size of colony did not exceed 50 individuals. Aphid populations disappeared 2 weeks later, and did not reappear. Rosette symptoms were not noticed. Crop growth was satisfactory in all the locations.

Results show that rosette did not occur during the 1996 dry season in Central Malawi despite the presence of the vector. Surveys in farmers' fields in the Chitedze area also did not reveal rosette symptoms on groundnut volunteers (Bottenberg and Subrahmanyam 1997). In addition, rosette was not noticed during two visits in Oct 1996 to a 6-ha irrigated vegetable farm with about 2 ha of groundnut near Salima, 100 km east from Chitedze (Bottenberg, unpublished data). These observations support our conclusion that rosette is not harbored by alternative hosts in Central Malawi during the dry season.

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Dry Season Survival of Groundnut Volunteer Plants and Ground Keepers (*Arachis hypogaea* L.) in Central Malawi

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One of the deficiencies in our understanding of the epidemiology of groundnut rosette, a major virus disease of groundnut in Africa, is where the virus complex survives during the dry season. The vector *Aphis craccivora* Koch has been recorded from a wide variety of alternative hosts during the dry season but none have been shown to carry any of the rosette viruses

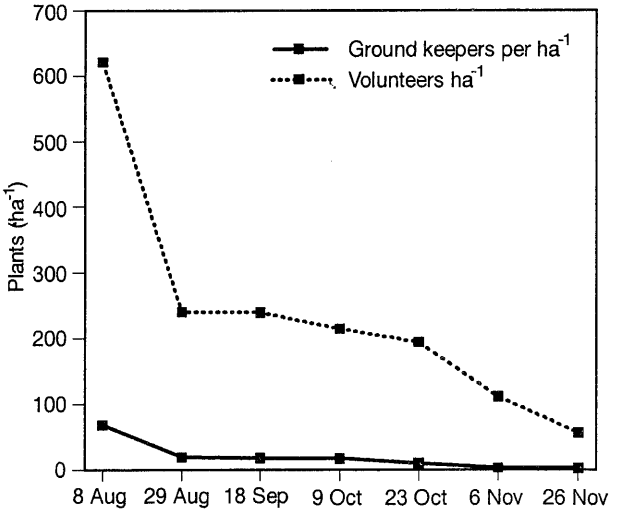

Figure 1. Densities of groundnut volunteers and ground keepers in farmers' fields (n = 21) in Central Malawi during the 1996 dry season.