quarantine. Hence adoption of fool-proof systems is impracticable, and approaches should be realistic.

Need for Surveys and for Research into Epidemiology of Groundnut Viruses

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Plant virus disease surveys are necessary to determine the incidence, severity, and distribution of viruses. Thus virus diagnosis is an important component of surveys. With the exception of groundnut rosette virus, the incidence and distribution of other groundnut viruses in Africa, especially those that are seed-transmitted, has yet to be determined. Very recently peanut stripe virus (PStV) has been found in seedlots imported into a number of countries from the People's Republic of China, and this virus has the potential to spread very rapidly. Indeed, groundnut seed had earlier been imported into a considerable number of countries from South and Southeast Asia, where PStV is now known to be widely distributed, and so PStV may be more widely distributed than is now known. As increasing numbers of disease surveys are carried out in different areas of Africa, there is a need to establish a central diagnostic laboratory in the continent to which groundnut samples can be sent for test. The samples could be moved as desiccated tissues, which pose no quarantine risk and can be utilized in serological tests. The feasibility of establishing such a laboratory, and for a possible cooperative groundnut virus disease survey should be considered. How far data from surveys can be utilized for precise estimation of crop losses due to viruses is debatable. Nevertheless, survey data should give some insight into the economic importance of virus diseases and help to provide justification for further research on virus disease problems and necessary funds.

If survey data can be integrated into geographical information system (GIS) programs, this will help in determining the distribution and severity of the different virus diseases in specific agroecological zones, and assist in our understanding of the ecology of the diseases. Cropping systems, planting dates, etc., could then be manipulated for active cultural control of the virus diseases. Also, breeders would be better placed in determining what other factors to incorporate when breeding virus-resistant varieties.

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According to Harrison (1983) 'a sound understanding of the epidemiology of plant virus diseases should be the key to rational control measures.' Epidemiological data have been very effectively used to control groundnut viruses. For example, groundnut may be protected from peanut stunt virus by avoiding planting of white clover in the vicinity, and data on thrips and aphid population levels occurring at various times during the growing season has facilitated control of tomato spotted wilt virus and groundnut rosette virus, respectively, by cultural methods.

Important epidemiological factors specially applicable to groundnut virus diseases, are the following.

- Populations of aphid species that can transmit peanut mottle and peanut stripe viruses, and their efficiency.
- Thrips species that transmit tomato spotted wilt virus.
- Hosts that support survival of vectors and viruses, especially during the off-season.
- Environmental factors that contribute to the survival and spread of vectors.
- Importance of seed-borne inoculum, in the case of seed-transmitted viruses, for secondary spread.

Breeding for Resistance to Groundnut Virus Diseases at ICRISAT Center

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At ICRISAT Center in India germplasm screening and resistance breeding projects are being carried out to produce varieties with resistance to bud necrosis disease caused by tomato spotted wilt (TSWV), peanut mottle virus (PMV), peanut stripe virus (PStV), and peanut clump virus (PCV) diseases. Breeding for resistance to groundnut rosette virus (GRV) disease is being done at the SADCC/ICRISAT Center in Chitedze, Malawi, in southern Africa.

TSWV has been reported in groundnut from many countries and is currently economically important in India and the USA. It is transmitted by *Thrips palmi* in India and by *Frankliniella occidentali* and *F. fusca* in the USA. TSWV is not seed-transmitted. Utilizing a field-screening technique developed at ICRISAT, more than 7000 germplasm accessions of cultivated groundnut and 42 wild *Arachis*

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