No. 1. However, maturity duration was 160 days in EC 36892, longer than in any of the three local varieties (Table 4).

Conclusions. The genotype EC 36892 showed high resistance to aphids both in greenhouse tests and in field trials. However, this resistance (and low PStV incidence in this genotype) cannot be used directly by farmers because of its long duration. However, EC 36892 is a very good genotype for aphid resistance breeding. The results also showed that Huohua No. 1, a spanish type, was much more susceptible to aphids than the two spanish × virginia hybrids, Hua 37 and Yihua No. 1.

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Survey of Groundnut Virus Diseases in Pakistan

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In Jul 1995, a survey of virus diseases was conducted in the major groundnut-producing areas in Pakistan, including Attock, Chakwal, and Rawalpindi districts. In Pakistan, groundnut is sown mainly in Apr and May. Groundnut-fallow-groundnut or groundnut-fallow-wheat are the main rotations used. However, a few farmers sow groundnut after harvesting wheat if there is sufficient soil moisture. Some farmers in the Pothar area sow groundnut in Jul, at the onset of the monsoon. More than 98% of farmers grow the well-adapted spreading variety, No. 334. Soils in the major groundnut-producing areas are sandy or sandy loam. Sowing is done either by broadcasting the seed followed by moldboard plowing, or by using a tractor-driven drill in which seeds are dropped manually. Low plant population, drought stress in the month of Jun, weeds, lack of proper machinery for sowing and harvesting, and damage by boars and other wild animals are the major problems that groundnut farmers face in Pakistan.

It was apparent from the survey that diseases are not a major constraint to groundnut production. However, in one field near Dhudial (on the way to Chakwal from Mandhra), peanut clump virus disease (PCV) was observed, with incidence ranging from 4 to 10%. The diseased plants occurred in patches and were severely stunted, with typical symptoms of mottling on the younger leaflets; the lower leaves were dark green in color. The soil was sandy, and the crop had been sown in April. The variety was the local spreading type. In one field (sown by extension staff as a demonstration plot) 10 km from Fateh Jang en route to Talaganh, we observed 5–15% incidence of peanut bud necrosis virus (PBNV). The field had been sown early, in rows, with a semi-spreading variety mixed with a local spreading type. Virus-infected plants showed typical PBNV symptoms, with chlorotic lines and ring patterns. Some plants showed complete necrosis of the growing terminals. PBNV was observed in every field surveyed in the Pothar area, but always at a very low incidence (less than 1%). In many fields, we also found a few scattered stunted plants, which we suspected were affected by PCV; but mottling symptoms were not clear on young leaflets. PBNV was also observed in groundnut fields adjacent to the road at several places—Tarbela Dam, Hazro Tehsil, Kamra, Attock, Fateh Jang, and Chakwal. At Barani Agricultural Research Institute (BARI), Chakwal, and at the National Agricultural Research Centre (NARC) farm, Islamabad, a few plants suspected to be infected by PBNV and PCV were recorded. Due to the presence of severe iron deficiency, which causes yellowing of the leaflets, it was difficult to detect symptoms of virus diseases.

Samples were collected at all the places surveyed, and tested by ELISA with antisera raised against PBNV and PCV. The ELISA results confirmed the presence of PBNV and PCV in Pakistan. Two serotypes of PCV were identified. At BARI, two suspected plants reacted with an antiserum raised against the Ludhiana isolate of Indian PCV. Another plant (also collected at BARI) reacted with antiserum produced for the Talod isolate of Indian PCV. The plants from Dhudial and NARC also reacted with antiserum produced for the Talod isolate. None of the samples reacted with antisera raised against the Hyderabad or West African isolates.

On the basis of this survey, we conclude that two virus diseases—PBNV and at least two known serotypes of PCV—occur in farmers' fields in Pakistan. The overall

crop condition was very good and no fungal diseases were observed, except for crown rot in some fields. Other virus diseases (e.g., peanut stripe, peanut mottle, and cowpea mild mottle viruses) were not observed.

Short- or medium-duration varieties are likely to be introduced in the near future to help farmers obtain two crops per year, wheat in the postrainy season and groundnut in the rainy season. We suggest that new introduced varieties should have resistance to PBNV. Fortunately, the local variety appears to have tolerance to PBNV, judging by comparative field observations with a newly introduced semi-spreading variety that showed very high PBNV incidence. This variety has not been identified. As for PCV, the new wheat-groundnut rotation being discussed for possible extension to farmers, will create conditions that will increase disease incidence; this has already happened in the states of Punjab and Rajasthan in India.

Various groundnut lines were sown at NARC in Jul 1995, in a sandy soil block where wheat is grown once every 2 years. In Sep, the crop was severely affected by PCV (30% incidence). We suggest that a non-preferred host for *Polymyxa* sp (the fungal vector of PCV), such as rapeseed, should be grown prior to groundnut in PCV-infested fields.

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Confirmation of the Effects of Plant Density and Irrigation on Peanut Bud Necrosis Disease Incidence

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Peanut bud necrosis disease (PBND), caused by peanut bud necrosis virus (PBNV), is an important disease in the major groundnut-producing countries (Reddy et al. 1992). The virus is transmitted by *Thrips palmi* (Vijayalaxmi et al. 1995). Several options are available for the management of PBND. These include the use of resistant cultivars, insecticides, and cultural practices (adjustment of sowing date and/or plant density, intercropping, elimination of alternative hosts, rogueing of diseased plants, etc.) (Reddy et al. 1991). This paper reports results from a field trial conducted at ICRISAT Asia Center during the 1993 rainy season to study the effect of irrigation and plant population on PBND in a sole groundnut cropping system.

Table 1. Effect of plant density and irrigation on bud necrosis disease on groundnut cv Robut 33-1, ICRISAT Asia Center, 1993 postrainy season.

Plant density ha^{-1}	Disease incidence (%)		
	Nonirrigated	Irrigated	Mean
100 000	12	8	9.8
200 000	7	3	5.3
300 000	3	1	1.9
400 000	2	1	1.2
Mean	5.8	3.3	
	SE	LSD	CV (%)
Population density (P)	±0.72	2.48	
Irrigation (I)	±0.45	1.46	
P × I	±0.96	2.91	34.1

Groundnut cv Kadiri 3 (Robut 33-1) was sown at four plant densities (100 000, 200 000, 300 000, and 400 000 plants ha^{-1}), and grown under perfo irrigation (at 10-15 day intervals) and without irrigation, on an Alfisol. The trial was laid out in a split-plot design with four replications, with plant densities as main plots and irrigation treatments as subplots of 36 m^2. PBND incidence was recorded on each plot 3 months after sowing. The total rainfall during the experimental period was 640.7 mm.

PBND incidence decreased significantly ($P = 0.05$) with increase in plant density up to 300 000 plants ha^{-1} (Table 1), confirming previous reports (Reddy et al. 1991). At 100 000 and 200 000 plants ha^{-1}, PBND incidence was significantly lower ($P = 0.05$) in irrigated plots than in nonirrigated plots. High PBND incidence under drought stress conditions has also been reported by Wheatley et al. (1989), who suggested that the lower incidence in irrigated plots was due to the distribution pattern of the thrips vectors.

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