

THE EFFECTS OF DROUGHT STRESS, FERTILIZER NITROGEN
AND INOCULATION ON NITROGEN FIXATION AND
YIELD OF COWPEA AND SOYABEAN

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ABSTRACT

Field trials were conducted in maha 1983 and yala 1984 with irrigation, N fertilizer, inoculation and mulching on cowpea and soyabean on Reddish-Brown Earths in Mahaweli System C. Irrigation to field capacity was at 25, 50 and 75% depletion of available water in 30cm depth in yala and without irrigation in maha, since soil moisture was not depleted to the specified levels due to incessant rains. Fertilizer-N treatments consisted of a low rate and split application with a high rate, while other treatments were with and without inoculation and mulching.

In maha the mean yield of inoculated soyabean was 1.76 t/ha, 40% more than the uninoculated, with or without N at the rate of 23 kg/ha. Yala yields were high, reaching more than 2 t/ha. Both fertilizer rates without inoculation resulted in 26% higher yields, compared with inoculation alone, with or without fertilizer, when well watered. N fertilizer significantly interacted with irrigation. A high N rate (46 kg N/ha), with split application, was beneficial only for the stressed plants. N fertilizer in combination with inoculation had no yield advantage over the application of N fertilizer alone.

In cowpea, neither inoculation nor N fertilizer application (11.5 or 23kg N/ha) resulted in significantly higher yields in the maha. In the yala N fertilizer or inoculation had no benefit at all on seed yield for well watered plants though N fertilizer was beneficial when plants were stressed. The pattern of yield response in yala was more or less the same as that of soyabean.

Mulching did not improve yields in drought stressed plants though it helped to maintain a slightly higher water status than the plants

that were not mulched.

Increase in leaf area in both crops was poor when stressed either by drought or water logging and consequently yields were affected.

Cowpea, unlike soyabean, exhibited a fairly high degree of drought avoidance, as indicated by maintaining higher pre dawn leaf water potential, remaining above -0.24 MPa, specific leaf weight ranging from 18.6 to 26.6g/sq.m and an air-canopy temperature difference of up to 3.8 C.

Inoculation resulted in a significant increase in nodule number and dry weight in both soyabean and cowpea. Drought stress reduced nodule dry weight significantly in both crops, however good nodulation with inoculation, when well watered, was not always reflected in seed yield. Total N accumulation was not affected by drought or inoculation, though percentage N was higher in inoculated plants.

It was evident that cowpea, with higher water use efficiency than soyabean, is better adapted to drought stress and irrigation can be withheld up to 75% depletion of available water without substantial loss in yield on these soils.