Effects of Temperature on Phenological Development, Yield and Quality of Mungbean.

by

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DECLARATION

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree.

I certify that to the best of my knowledge any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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Abstract

Temperature and the nutritional status of the soil are considered to be major limitations for mungbean production in Australia. Comparative yields appear lower than those of Southeast Asian countries and they appear more variable than other summer crops in Australia.

A series of experiments indicated a number of important factors affecting yield including cultivar, temperature, fertiliser and fertiliser application methods. Such responses were examined in pot trials in the glasshouse and under field conditions and also in growth cabinets.

Phasic development patterns of mungbean were sensitive to temperatures; both high and low temperatures shortened phase length whilst lower temperatures showed the reverse effect. The length of the phenological stages of mungbean was strongly correlated with cumulative degree days or heat units (HU) with correlation coefficients greater than 0.9. A high accumulation rate of heat units or degree days reduced the length of all phenological stages with the reverse occurring at higher temperatures thus balancing the degree day requirement.

The total dry matter production and economic yields of mungbean were high under a wide temperature range (5°-30°C) under field conditions compared to 15°-39°C in glasshouse conditions. The longer maturity period under lower temperature regimes increased the total vegetative dry weights and yields. Nitrogen content of seeds was not greatly affected by temperatures.

Initial studies indicated that low day and night temperatures (22°C and 4°C respectively) drastically reduced grain yield and dry matter production at all levels of fertiliser applications while yield was satisfactory under high day and night temperatures (39°C and 15°C).

Low temperatures adversely affected the flowering phase and completely inhibited flower production and pod formation when plants grew under low day and low night temperature

conditions. However when plants were exposed to low temperatures during the vegetative stages, this appeared to lengthen the total growing period and increased seed yield.

A range of night temperatures (6°, 9°, 12°, 15°, 18°, 21°, 24° and 27°C) combined with warm days (30°C) had different effects on flowering. Yield of mungbean under a night temperature of 6°C was high compared to the remaining treatments.

Seed quality of mungbean is determined by colour, size and percentage germination; these were influenced by growing conditions. Temperature during growth influenced seed colour and germination percentage; the highest germination percentage was obtained from seeds produced under glasshouse conditions. However, the cultivar Shinsho had close to 100% germination under all treatments and also maintained its seed colour under all growing conditions.

Considerable differences in cultivar response to temperature and growing conditions were observed. Under pot conditions with differing temperatures differences in cultivar response in dry matter and grain yield were small, however under field conditions V6-1973A produced the highest dry matter and grain yield.

The experimental programme indicated that new cultivars of mungbean were able to tolerate low night temperatures (down to 6°C) combined with warm days and that mungbean could be grown successfully in the field under northern Tableland conditions.

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