MAIZE IN THE MANAWATU

A FIELD STUDY OF THE EFFECTS OF SPACING AND VARIETY UPON THE GROWTH OF ZEA MAYS L.

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SUMMARY

An experiment is described in which two commercial dent maize varieties, W575, a late maturing hybrid, and KC3, an early maturing hybrid were grown at equidistant spacings in five populations of from 39,000 to 79,000 plants.ha^{-1}. Plants were sampled on ten occasions from 44 days after planting to field maturity, and leaf area, dry weights of shoot components, and dry matter contents determined. Analyses of variance were performed on the data, polynomials fitted to plot means of the variables, and growth analysis carried out.

On average the late variety (W575) outyielded KC3 in grain production by 12%. Although ears in both varieties were similar in weight, they were more numerous in W575, particularly at wide plant spacings. Consequently yields in the two varieties were similar at high plant densities but superior in W575 at low plant densities. Tillers provided 10% of total shoot weight at 50% silking but bore only 2% of the final grain yield. Plants of the early variety possessed only 50% of the leaf area of the late variety. The difference arose from a lower leaf number, smaller leaf size, and a smaller tiller component, which were slightly offset by longer internodes giving a greater proportion of stem area.

At maturity, KC3 was characterized by a lower proportion of stem, leaf and cob, and a greater proportion of grain and tassel than the late variety. The proportion of husk was similar in both varieties.

The total shoot dry weight production of W575 exceeded that of KC3 because of a higher average crop growth rate and a longer period of growth. The late maturing variety was the more efficient in converting incident radiation into total shoot dry weight, but this efficiency was similar in both varieties for grain production.

Growth analysis revealed that the higher crop growth rate of W575 prior to silking was due primarily to an 11% higher unit leaf rate. The significantly lower leaf area ratio of this variety indicated a superiority of gross photosynthesis in this variety. The superiority of crop growth rate in W575 after flowering was principally due to its 67% higher leaf area index, and to the more rapid ageing of KC3. The grain leaf ratio, C, of the early variety significantly exceeded that of W575, though it was comparatively uniform within any single variety.

Considerable losses of dry weight from non-grain shoot components occurred during the late grain filling period of both varieties. Mobilization of previously established reserves may have accounted for 8.4% and 4.2% of final grain yield in KC3 and W575 respectively. This proportion increased with plant density in KC3, but not in W575.

The time from silking to senescence was greater than that observed in many other countries. Leaf area was reduced to 50% of its maximum value

approximately 10 weeks after silking, and 68 and 79 days elapsed between silking and 95% completion of grain filling in the early and late varieties respectively. Varietal differences in grain yield were due to differences in the length of the grain filling period rather than in the rate of grain filling. Reasons for delayed plant senescence and its implications on maize productivity are discussed.

The optimum plant population for grain production in KC3 did not occur within the range of densities tested, though that for W575 appeared to be close to the upper end of the range of plant densities grown. Optimum plant populations calculated from regressions of the logarithm of grain weight per plant on density were 92000 plants.ha^{-1} (W575) and 157000 plants.ha^{-1} (KC3), and appeared to reflect differences in plant size.

The rate of increase in grain dry matter content was significantly greater in W575 than in KC3.

Implications of these findings on plant growth and crop yield are discussed in the light of current knowledge and hypotheses on the physiology of growth and productivity in maize.