GROWTH AND DEVELOPMENT STUDIES WITH BROCCOLI

(Brassica oleraceae var. italica)

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Abstract

The influence of temperature on the growth and development of broccoli was studied in the field, the greenhouse and in controlled climate experiments at Massey University in 1985-88. In the field experiment, 6 sowings at 2-month intervals of four cultivars of broccoli were made. The effect of temperature on a number of growth and development parameters of the plant was assessed using the heat unit system. The greenhouse and controlled climate experiments were conducted as follow-up studies to determine the independent effect of temperature on the development, growth, maturity characteristics and curd quality of broccoli. In all the studies, growth analysis using the functional approach was employed.

Temperature, through the use of the heat unit system, was found to account for a major proportion of the variation between sowing dates in the rate of dry matter accumulation, rate of leaf production, times to curd initiation and maturity, and rate of curd growth. Dry matter accumulation could be expressed as a logistic function of heat unit summation (HUS) above a base temperature of 3C; rate of leaf production, a linear function of HUS above -2C; and curd growth (increase in curd diameter), as a quadratic function of HUS above 3C.

Time to curd initiation expressed as number of heat units was calculated above a base temperature of 0C. The varietal constants (total HUS from sowing to curd maturity) were calculated to be 1188, 1123, 1217 and 1347 heat units for Premium Crop, Mercedes, Idol and Fordhook Late, respectively.

The final number of leaves did not vary with sowing date but varied among the cultivars and was related to the time to curd initiation. The longer the time to curd initiation, the more leaves were formed.

The economic yield varied with sowing date and was related mainly to differences in total dry matter accumulation potential. With the cultivars, the harvest index was equally important. Differences in total dry matter accumulation between cultivars were not closely linked to differences in the relative growth rate (RGR) or any growth parameter, but were related more to

the growth duration. There was some indication of a relationship between harvest index and net assimilation rate (NAR) at curd initiation time. NAR was found to be inversely related to the specific leaf weight (SLW) which is indicative of the thickness of the leaves.

High temperature regime (30C) reduced the RGR and NAR of plants relative to a 20C regime. It did not affect rate of leaf production and did not prevent or delay curd initiation. When imposed before the curd initiation stage 1-week exposure to high temperature did not reduce curd quality. When imposed at the early or late curd development stages it reduced curd quality with the reduction being more pronounced at the latter stage. When treatment exposure was increased to two weeks similar results were obtained. Growing the plants under continuous high temperature caused a range of curd morphological abnormalities such as the presence of bracts throughout the surface of the curd, suppression of the growth of the buds or irregular elongation of curd internodes.

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List of Abbreviations

Abbreviation	Meaning
CI	Curd Initiation
CM	Curd Maturity
CV	Coefficient of Variation
DFS	Days from Sowing
EGA	Endogenous Gibberellin Activity
EMS	Error Mean Square
HUS	Heat Unit Summation
LAR	Leaf area ratio
LWR	Leaf weight ratio
NAR	Net Assimilation rate
RGR	Relative growth rate
SD	Sowing Date
SLW	Specific leaf weight