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PHOTOSYNTHETIC LIGHT RESPONSE OF SIX CLONAL SELECTIONS OF THE SWEETPOTATO CULTIVAR 'BEAUREGARD'

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Background. Photosynthesis is the largest-scale synthetic process on earth and is essentially the only mechanism of energy input into the living world. In plants, the assimilation of atmospheric carbon dioxide into organic acids plays a dominant role in crop growth and ultimately final yield. The physiological linkages between photosynthesis and growth and yield of many of the major agronomic crops have been examined over the past few decades. However, due to a lack of research, these relationships have not been studied for many of the major horticultural crops including sweetpotato.

Unlike most horticulturally important food crops, sweetpotato is propagated vegetatively rather than by seed. Without careful selection and maintenance of 'seed' potato stocks, yields and quality characteristics can be reduced due to random mutations and genetic drift. In 1996-97, major production problems for sweetpotato growers in East Texas included nematode infestations and related yield and quality reductions. Sweetpotato growers from Van Zandt, Wood and Rains Counties of East Texas selected eight individual potatoes of the cultivar 'Beauregard' which exhibited a wide range of quality characteristics (Table 1). These selections were cloned at the Texas A&M Vegetable Improvement Center, College Station, TX in order to produce a large number of slips for field trials. At Overton, one of our objectives was to determine if photosynthetic light response differed among these clones.

Research Findings. Leaf photosynthetic light response for six of these clonal selections was determined during a greenhouse experiment conducted at the Texas A&M University Agricultural Research and Extension Center at Overton, TX using a portable leaf photosynthesis system. Photosynthetic assimilation (A) vs. photon flux density (PPFD) were iteratively fit to a rectangular hyperbola of the form:

$$A = A_{\max} * (1 - \text{EXP}(-QE * \text{PPFD}/A_{\max})) - R_d$$

where A_{\max} is the asymptotic assimilation at infinite PFD, QE is quantum efficiency and R_d is dark respiration. Shown in Fig. 1 is an example of the photosynthetic light response for two of these clones. Significant differences ($P \geq 0.05$) were detected in all three of these parameter estimates among the six clonal selections (Table 2). Parameter estimates ranged from 23.4 to 28.8 $\mu\text{mol} (\text{CO}_2) \text{ m}^{-2} \text{ s}^{-1}$, 0.056 to 0.071 $\mu\text{mol} (\text{CO}_2)/\text{mol} (\text{photons})$, and -0.9 to -2.0 $\mu\text{mol} (\text{CO}_2) \text{ m}^{-2} \text{ s}^{-1}$ for A_{\max} , QE and R_d , respectively. However, these differences were not clearly related to quality characteristics determined for these clones in field trials.

Application. Differences in photosynthetic parameters among these clones suggest a genetic basis for these differences. Further research is needed to determine potential correlation of these parameters with yield and yield components. To date, there are no previously published reports on photosynthesis of sweetpotato.

Table 1. Descriptions of individual sweetpotato selections used in photosynthesis study.

Selection	Description
A	Near perfect quality (size and shape) selected by Clyde Barber
B	1996 Foundation seed from Chase Research Station
C	1995 Foundation seed from Mark Coker, yielded 500 marketable bu/ac
D	Poor selection from East Van Zandt County
E	Poor selection from Rains County
F	Poor selection from Rains County

Table 2. Parameter estimates for the rectangular hyperbola model fit to leaf photosynthesis of six selections of the sweetpotato cultivar 'Beauregard'.

Selection	A_{\max} $\mu\text{mol}(\text{CO}_2)\text{m}^{-2}\text{s}^{-1}$	QE $\text{mol}(\text{CO}_2)/\text{mol}(\text{photons})$	R_d $\mu\text{mol}(\text{CO}_2)\text{m}^{-2}\text{s}^{-1}$
A	26.1 B	0.0640 AB	-1.05 A
B	28.8 A	0.0628 AB	-1.92 B
C	25.2 BC	0.0629 AB	-1.32 AB
D	27.5 AB	0.0714 A	-1.96 B
E	25.0 BC	0.0619 AB	-1.96 B
F	23.4 C	0.0561 B	-0.94 A

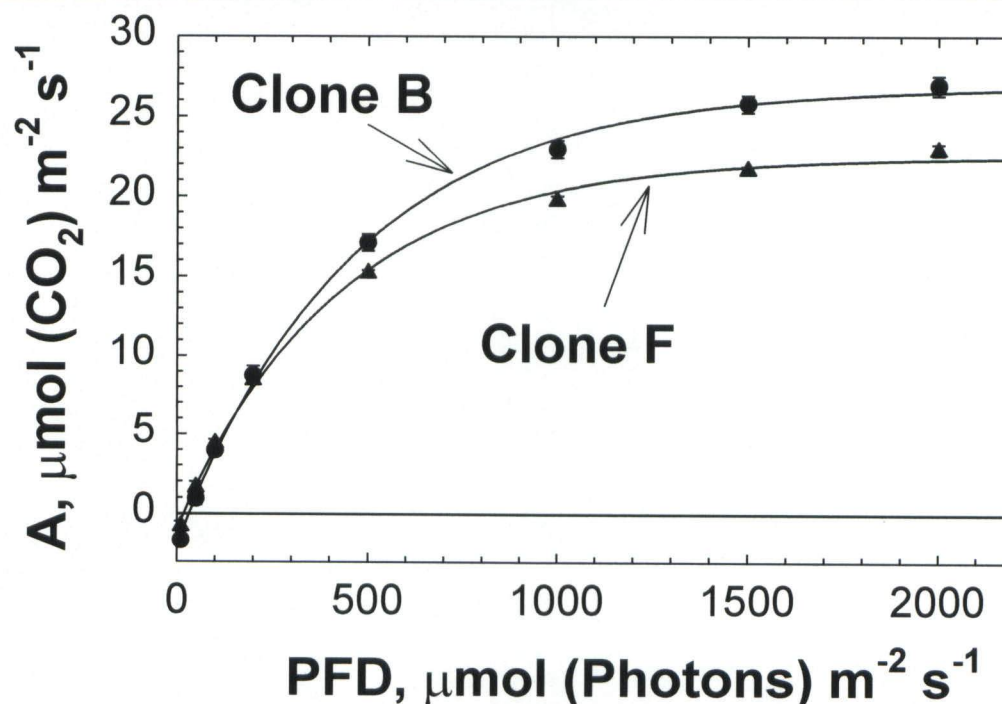


Fig. 1. Leaf photosynthetic light response curves for two contrasting clones of Beauregard sweet potato.