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Effect of Length of Growing Season on Protein Content of Sweet Potato Cultivars[1]

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Abstract. **Protein and dry matter contents were determined for 16 cultivars of sweet potatoes (*Ipomoea batatas* (L.) Lam.) planted May 28 and harvested on 4 different dates. Means of protein contents of cultivars differed significantly and ranged from 4.17% to 6.51%, dry basis. Protein content decreased at the rate of 0.0067% per day and dry matter decreased at the rate of 23% per day.**

Purcell et al. (7) reported that protein content of 99 cultivars of sweet potatoes, ranged from 1.73% to 9.14% on a dry wt basis. These values were within the range reported throughout the world (3, 4, 6). Efforts have been made to determine factors which might provide sweet potatoes products with substantially increased protein content. It is known that total yield of roots increases with length of growing season (1) but no reports concerning changes of protein content as a function of length of growing season were found.

Sixteen sweet potato cultivars, replicated 4 times were planted in Norfolk sandy loam at the North Carolina State Experiment Station farm near Clayton, North Carolina. The plots were planted May 28, 1972, with 506 kg/ha of 6N–5.2P–10K fertilizer. At the last cultivation in late July, the plots were side dressed with 506 kg/ha 8N–0P–20K. In late August, 33 kg/ha of N was applied. Diazion was applied in late July to control wire worm.

On each of 4 harvest dates, Sept. 6, Sept. 27, Oct. 18 and Nov. 8, 2 hills from each replicate were harvested. These dates represented 102, 123, 144 and 165 days respectively from planting to harvest. Within 24 hr of harvest all roots 25 mm in diam and larger were washed and dried for 2 hr at room temp. Roots from both hills were ground in a meat grinder and thoroughly mixed. Samples weighed to 0.1 mg were frozen at −10°C until analyzed. All samples were analyzed within 3 days. samples were analyzed within 3 days. Nitrogen was determined by the Kjeldahl method using copper and selenium catalysts and protein was calculated as 6.25 x N. Dry matter was determined by drying the samples at 100-105°C for 16 hr.

Overall means of replicates and harvest dates (Table 1) show a range of protein content in cultivars from 4.12% to 6.51% with significant differences among cultivars. There were also significant differences among cultivars in dry matter content. Overall replicate means of protein and dry matter indicated that protein content decreased linearly at the rate of 0.0067% per day, between 102 and 165 days (Table 2). Dry matter decreased linearly at the rate of 0.233% per day during the same period. Both trends were highly significant. Lack of significant date-cultivar interactions in either protein or dry matter suggests that all cultivars behaved essentially the same.

The growing season of 1972 had enough rainfall throughout the harvest period to keep plants from showing signs of stress, and there was no notable excess rain.

Dry matter has been used as an indicator of starch content (4). Presumably increases in starch would lower the concentration of protein by dilution. The overall correlation between % dry matter and protein was −.07 (significance level .25). However, when effects of cultivar and harvest date were removed the correlation became −.32 (significance level beyond .0001). Thus, while starch, as measured by dry matter may lower protein in an individual cultivar, differences among cultivars in dry matter-protein ratios is highly significant. It appears, therefore, that high dry matter content does not preclude high protein content. Constantine et al. (2) have shown that high moisture levels cause a decrease in both dry matter and protein, further indicating that protein content is not a reciprocal function of dry matter content.

Table 1. Protein and dry matter content of sweet potato cultivars. Means of 4 replicates and 4 harvest dates.

Cultivar	% protein dry basis	% dry matter
Goldrush	6.51a[z]	26.0eg
Centenial H-19	6.33ab	29.2a
Julian	6.27ab	25.1gi
Centenial	6.10abc	27.2ce
Porto Rico	5.85bcd	28.2ab
Jewel	5.60cde	25.5fh
Jewel Mutant	5.44de	24.0i
Porto Rico Mutant	5.31de	28.6ab
213x228-1	5.27e	28.3abc
214x196-1	5.16e	24.0i
241x196-6	5.15ef	23.7j
171x196-3	5.14ef	27.7bd
241x102-1	4.61fg	24.7hj
171x213-1	4.51g	28.0a
196x228-5	4.42g	26.6af
241x102-2	4.17g	27.3c

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

Table 2. Changes of protein and dry matter content of sweet potatoes as a function of days between planting and harvest (means of 16 cultivars and 4 replicates).

Days	% protein (dry basis)	% dry matter
102	5.60	27.3
123	5.43	26.6
144	5.25	26.5
165	5.19	25.7

Although protein content decreased significantly with increased length of growing season, it appears that selection of high protein cultivars offers greater promise of obtaining high protein sweet potato products than utilizing early harvest. The data of Beattie et al. (1) suggests that rate of increased yield is nearly 3 orders of magnitude greater than the rate of decline in protein content, suggesting that early harvest may not always be economically justified.

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