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EVALUATION OF ONION GERMPLASM FOR YIELD CHARACTERISTICS IN THE US VIRGIN ISLANDS.

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ABSTRACT

Onions (*Allium cepa* L.) are a very popular, culinary, import commodity in the US Virgin Islands. Local production is minimal. Therefore, a large market exists for onions grown locally. Six short-day onion cultivars, 'Contessa', 'Granex 33', 'Granex 429', 'Texas Grano 502', 'Texas Grano 1015' and 'Texas Grano 1025' were field evaluated during the 1994 and 1995 growing seasons. Parameters measured were bulb diameter, bulb height and yield. In 1994, Granex cultivars produced bulbs with the largest (Granex 429, 77.4 mm) and smallest (Granex 33, 69.6 mm) diameters. Bulb height varied from 60.4 to 76.0 mm with the Texas Grano cultivars producing bulbs that were taller than the other cultivars. Mean yields of onions were significantly higher for Texas Grano 1015 (32.4 t/ha) compared to Texas Grano 502 and Granex 33 with yields of 25.1 and 18.6 t/ha, respectively. Granex 33, the earliest maturing of all the cultivars, produced the lowest yield and the smallest bulbs. In 1995, Texas Grano 1015 produced the largest bulbs (diameter and height) and also the highest yield. Increases in yields were observed for all cultivars in 1995 when compared with 1994. The time taken for cultivars to reach maturity was also longer during the second year.

INTRODUCTION

Onions have been cultivated and used as food from the earliest periods of recorded history. The crop ranks as one of the most important vegetable crops. The demand for onions is worldwide, and they are grown and consumed by people of all nationalities. The crop is grown and harvested primarily for fresh use. Except for seed production, this biennial herbaceous plant is grown as an annual. The bulb, for which the crop is grown, is only formed when favourable conditions exist regarding day-length, temperature and the stage of maturity of the crop (Yamaguchi, 1983).

Onions are probably the major culinary herbs of the world. All plant parts produce a strong onion odour when crushed (Purseglove, 1972), and all cultures seem to use these pungent bulbs to enhance the flavour of their food (Langer and Hill, 1991). The onion can be served in dishes in a multiplicity of ways. The immature and mature bulbs can be eaten raw or may be boiled, fried, stewed, baked, creamed or roasted (AVRDC, 1990). They are used in soups, salads, sauces and for seasoning many foods. Fried onion rings (french-fried) are a popular item packed, particularly for the fast-food restaurants, by the frozen-food

industry. Dried onion powder and onion salt are used for culinary purposes (Purseglove, 1992). Onions add pleasure to most meals and have found a place in most recipes (AVRDC, 1990).

Day-length is important in the growing of onions for bulbs. The critical day-length varies from 11to 16 h and cultivars are classified according to the approximate photoperiod necessary to induce bulbing; short day (>12–13 h), intermediate (>13.5–14 h), long day (>14.5–15 h), very long day (>16 h). Bulbing occurs when the photoperiod is longer than the minimum day-length characteristic for the cultivar (Yamaguchi, 1983). The photoperiod for bulbing really cannot be specified without also specifying the temperature because temperature also plays an important role in bulbing. Onions need high temperatures to trigger their reaction to the effect of long day-length on bulb formation. Tropical onion cultivars can grow at temperatures between 22 and 30 °C (Messiaen, 1994). High temperatures seem to shorten the time necessary for the bulbing response but very high temperatures can retard bulbing.

Cool temperatures and an adequate moisture supply are needed during the early growth stages to provide the maximum vegetative growth desired before bulbing is initiated. The size of the mature bulb will depend on the size of the plant at the beginning of bulbing (Yamaguchi, 1983). The more foliage growth, encouraged by good soil fertility, moisture and temperature, the more likely that good to excellent bulb yields will be obtained (AVRDC, 1990). When conditions become favourable, the plant deposits carbohydrates in the leaf bases which swell up to produce the onion bulb, while the outer leaf base layers become papery and provide protection for the developing bulb (Langer and Hill, 1991). Hot, dry conditions are preferred for maturation, ripening and harvesting.

Most onion cultivars are very sensitive to day-length and temperature and their range of adaptation is very limited. Consequently, cultivars should be developed for a particular region, and this is very important for the short days of the tropics. Introduction of any new cultivar should be preceded by checks to ensure that its optimal growth temperature and photoperiodic requirements are compatible with local climatic conditions. It is essential that cultivars be carefully tested under local conditions to ascertain their suitability. Cultivars recommended for the tropics include 'Granex' and 'Texas Grano" (Purseglove, 1972).

Seed companies are continuing to make progress in breeding short day-length onions and there are cultivars adapted to tropical areas that develop bulbs in increasing day-length conditions of 11-13 h, or that are almost completely day neutral (Messiaen, 1994).

Short-day cultivars are best suited for Caribbean environmental conditions but production is restricted to the time of year when these cultivars can be planted. This means transplanting in December and January for harvesting in March, April and May. Because of their short shelf-life these cultivars are grown mainly for immediate consumption.

Onions are grown on nearly all types of soils but do best on a sandy loam with a well-drained clay subsoil. Transplants ensure earlier maturity, larger bulbs, greater uniformity,

and less competition from weeds. Because of its shallow root system, the onion plant is very vulnerable to loss of moisture from the upper layers of the soil. Supplemental watering must be provided if the crop is to maintain efficient growth (AVRDC, 1990). When the tops begin to fall down the bulbs are ready to harvest.

A cultivar should be high-yielding, attractive, uniform in size, shape, colour and time for maturity, and resistant to diseases and pests. Attention should be given to crispness, juiciness, mildness or pungency, sweetness and keeping qualities of the bulbs (Purseglove, 1972).

Despite high priority efforts towards self-sufficiency by most Caribbean governments, more than 8,000 t of onions are imported annually. Constraints to self-sufficiency are seasonality of production, limited availability of irrigation water, poor shelf-life of most short day cultivars, and pests and diseases (Chandler, 1994). Onion imports to the Virgin Islands during 1993 were 1,728,483 kg at a cost of US$3,342,000 from the United States. An additional $1,334,000 was spent on onions from other areas (V.I. Bureau of Economic Statistics).

MATERIALS AND METHODS

The trials were conducted at the University of the Virgin Islands' Agricultural Experiment Station, St Croix. The soil is a Fredensborg loamy, fine, carbonatic, isohyperthermic, shallow, typic Calciustoll (Lugo-Lopez and Rivera, 1980).

Onion seeds of six cultivars (Contessa, Granex 33, Granex 429, Texas Grano 520, Texas Grano 1015 and Texas Grano 1025) were sown in Speedling trays (Speedling Mfg., Fl) containing Pro Mix BX (Premier Brands, PA) in October 1993 and 1994. Seedlings were transplanted into the field at 47 days after seeding for both trials. The experimental design was a randomized complete block with four replications. Plots consisted of three rows 3.6 m long, with a spacing of 0.3 m between plants and 0.3 m between rows. A drip irrigation system was installed consisting of 1.27-cm poly-hose (Hardie Irrigation) as the submains and 15 ml Hardie New Tape (Hardie Irrigation) with laser drilled orifices 0.3 m apart as the laterals. Soil moisture levels were maintained at field capacity until the crop approached maturity. Fertilizer was band applied at rates of 150 kg N, 100 kg P and 200 kg K per ha, using ammonium sulphate, triple superphosphate and sulphate of potash, respectively. All weeding was done manually and no pesticides were applied, even though sporadic infestations by defoliators were observed in the plots during the growing season. Mean maximum daytime temperatures during the 1994 growing season ranged from 28.8 °C in February to 30.1 °C in April. Temperatures during the 1995 growing season ranged from 28.9 °C in March to 31.3°C in May. Onions were harvested when the tops of the plants began to fall over (or the necks were broken). There were two harvests in both trials because some cultivars matured earlier than others. Data collected were the diameter, height and weight of the onion bulbs. All data were analyzed using the GLM procedures of the SAS (SAS Institute, Cary, NC). The objective of this 2-year study was to identify high yielding,

consumer acceptable, onion cultivars with adaptation to local environmental conditions for production in the Virgin Islands.

RESULTS AND DISCUSSION

Granex onions harvested in 1994 produced bulbs with the largest (Granex 429, 77.4 mm) and smallest (Granex 33, 69.6 mm) diameters (Figure 1). Bulb height varied from 60.4 to 76.0 mm (Figure 2) with the Texas Grano cultivars producing bulbs which were taller than the other cultivars. Mean yields of onions were significantly higher for Texas Grano 1015 (32.4 t/ha) compared to Texas Grano 502 and Granex 33 with yields of 25.1 and 18.6 t/ha, respectively (Figure 3). Granex 33 was the earliest maturing of all the cultivars, harvested at 81 days after transplanting (DAT). This cultivar produced the lowest yield and the smallest bulbs.

In 1995 the second year of the study Texas Grano 1015 (Figure 1) produced bulbs with a significantly larger diameter (100.7 mm) than Contessa (80.1 mm). Texas Grano 1015 also produced bulbs with a height of 95.1 mm, which were significantly taller than from all other cultivars (Figure 2). Even though Granex 33 was harvested earlier (at 127 DAT) than the Texas Grano cultivars the bulb diameter (96 mm) and yield (49.2 t/ha) of Granex 33 ranked second among all cultivars

All cultivars produced yields above 39 t/ha in 1995, with mean yields ranging from 39.3 t/ha for Granex 429 to 53.2 t/ha for Texas Grano 1015 (Figure 3). Texas Grano 1015 produced the highest yield of onions in both years. Increases were observed for all cultivars regarding yield and the time for crop maturity in 1995 compared to 1994. The yield increases ranged from 31% for Granex 429 to 164% for Granex 33 and may be due to environmental changes including temperature and day-length. The time for crop maturity was 81–110 days in 1994 and 127–154 days in 1995.

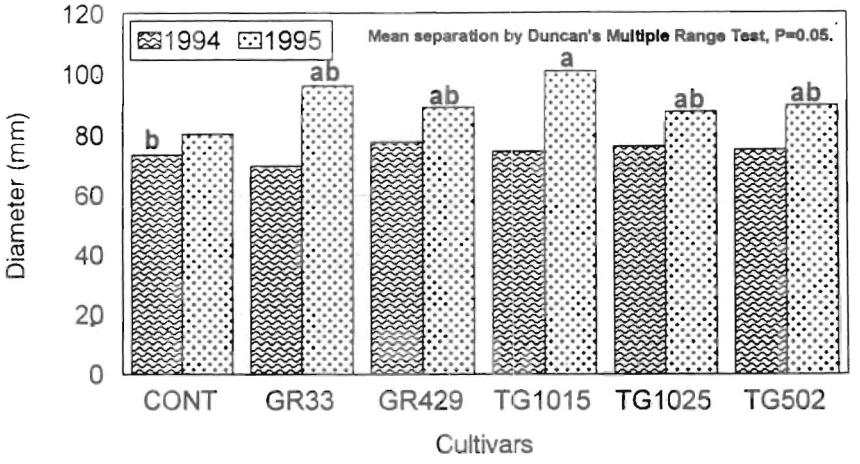

Figure 1 Bulb diameter of six onion cultivars grown during the 1994 and 1995 season

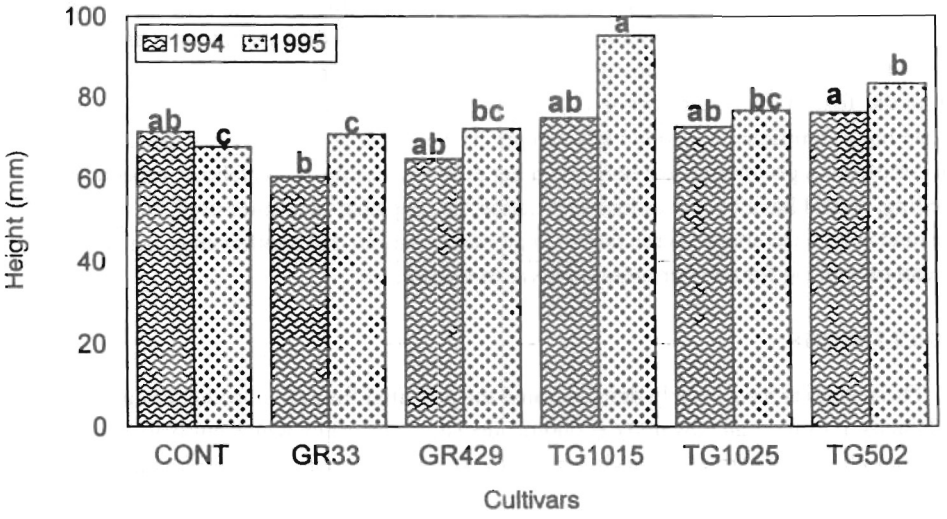

Figure 2 Bulb height of six onion cultivars grown during the 1994 and 1995 season
Mean separation by Duncan's Mulitple Range Test, P=0.05

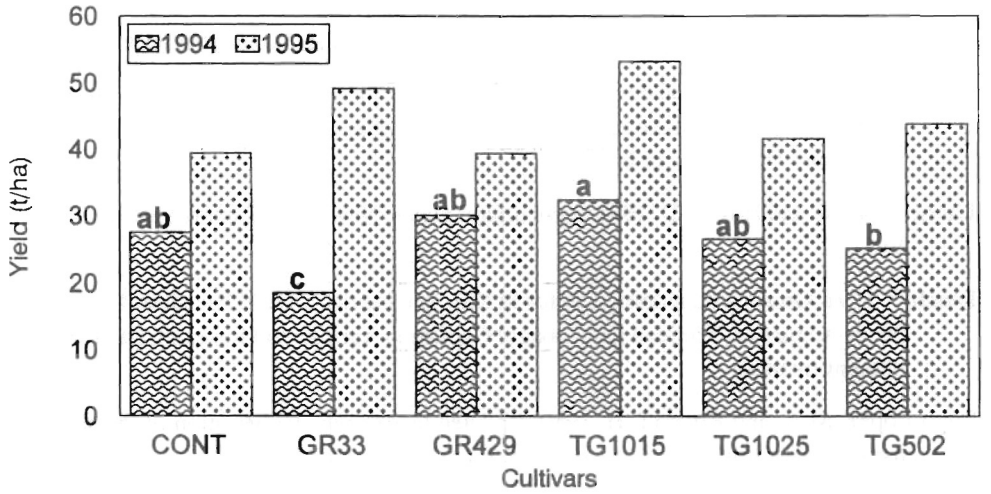

Figure 3 Yield of six onion cultivars grown during the 1994 and 1995 season
Mean separation by Duncan's Mulitple Range Test, P=0.05

Chandler (1994) reported that onions are sensitive to small environmental changes which cannot only affect a cultivar's performance from location to location but also the same location from year to year. Yields obtained in these trials are comparable to yields from other Caribbean countries which ranged from 17 t/ha in Montserrat to 45 t/ha in Barbados (Leach, 1991).

Contessa is a white skinned cultivar and as such can be marketed as a specialty onion. Granex 33 produced very good yields in 1995 compared to low yields in 1994. The performance of this cultivar in 1995 merits further evaluation regarding its potential as a recommended cultivar. It is the earliest maturing of all the cultivars tested, harvested 1 month before the Texas Grano cultivars in both years. This early maturity characteristic of Granex 33 can have significant economic advantages. The cultivar will be early on the market and can command a premium price until the other cultivars mature. Less labour, especially for weeding, would have been required to produce the crop also less water used for irrigation. The land is made available to the farmer at an earlier date so that another crop can be grown instead of waiting for another onion cultivar to mature.

CONCLUSIONS

These studies have clearly demonstrated the potential for onion production in the Virgin Islands. Farmers can now make economic decisions regarding which cultivar(s) to plant. They can plant cultivars with varying maturity to ensure a longer period of availability of fresh local onions on the market. This can be accomplished by planting both Granex and Texas Grano cultivars.

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