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Reviewed Research Paper

Yield Stability in 10 Cultivars of Strawberry[1]

JAMES F. HANCOCK[2]

Abstract

Ten strawberry cultivars were harvested for a total of 7 years at two sites in Michigan. A regression of individual yields on mean yields of all cultivars was calculated to measure phenotypic stability. 'Scott,' 'Raritan,' 'Redchief' and 'Midway' proved to be the most stable high yielding cultivars, while 'Guardian' had high yields but was much less stable.

Introduction

A well adapted cultivar maintains its productivity regardless of the vagaries of nature. Cultivars with modest yield potentials can be more profitable than those with higher yield ceilings if they are more consistent producers from year to year.

In yield trials of fruit, little attempt has been made to measure consistency of production outside of calculating means or coefficients of variation. These measurements are useful, but they tell us little about genotype-environmental interactions. Finlay and Wilkinson (1) have developed a stability analysis using linear regression which measures a genotype's relative response to environmental variability (2). In this study, I describe and use this analysis to measure and characterize yield stability in 10 cultivars of strawberries grown under Michigan conditions for 7 years.

Materials and Methods

The trials were performed at Sodus, Michigan from 1978-1982 and at Traverse City, Michigan from 1979-1982. Average climatic conditions for these two sites are depicted in Table 1. During the course of this study, a wide

[1]Michigan State University Agricultural Experiment Station Journal Article No. 11441.

[2]Associate Professor, Department of Horticulture, Michigan State University, East Lansing, MI 48824.

Table 1. Average climatic conditions at Traverse City and Sodus, Michigan.

Parameter	Sodus	Traverse City
January temperature (°C)	4.1	5.4
July temperature (°C)	22.4	21.1
Rainfall (cm)	14.3	10.8
Frost-free days	158	149

array of environmental conditions were experienced including unseasonably wet, cool springs and hot, dry summers.

Dormant, spring dug plants of 10 cultivars were set in 3 m plots at spacings of 60 cm within rows and 1.5 m between rows. A randomized block design was used with 4 replicates of each treatment. Flowers were removed in the first year at each site and the plants were trained to 35 cm-wide matted rows. Fruit (yield) was obtained at 5 day intervals in the bearing years. Matted row densities did not appear to vary more than 5-10% within cultivars.

The cultivars were grown according to conventional cultural practices. Herbicides and cultivation were used to control weeds. Approximately 33 kg of actual nitrogen per hectare was added before planting and 56 kg/ha was furnished immediately after harvest. Irrigation was supplied for frost protection and during drought periods. The soils at both sites were sandy loams with excellent drainage.

Mean yields were calculated in each environment for individual cultivars and the total array of cultivars (environmental means). A linear regression was then performed on the individual cultivar and environmental means. A

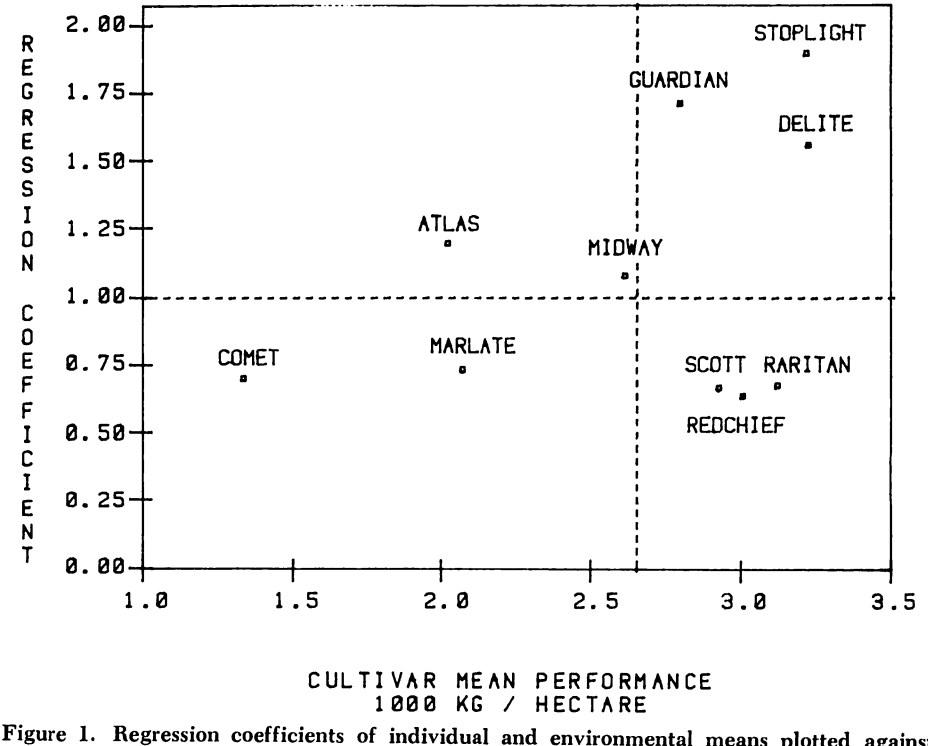

Figure 1. Regression coefficients of individual and environmental means plotted against entity mean performances.

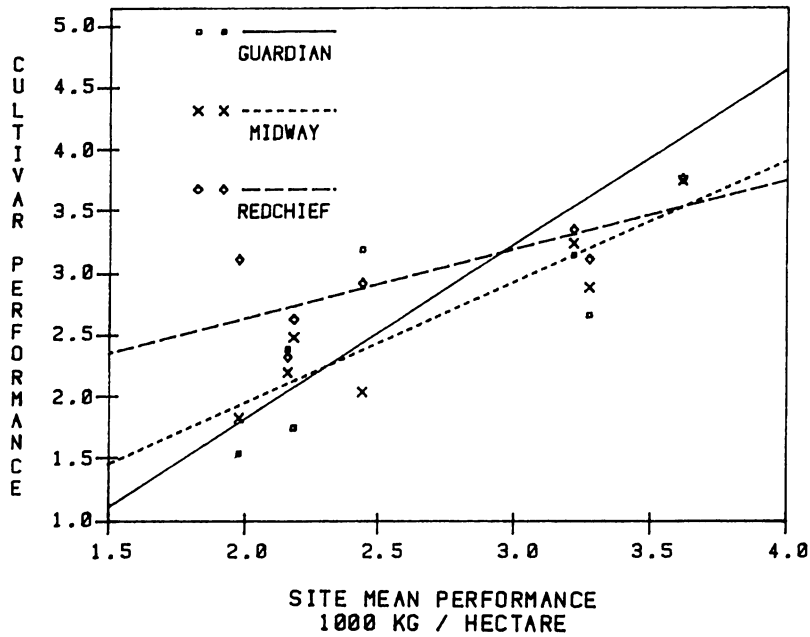

Figure 2. Regression of individual cultivar performances on environmental means.

scatter diagram was constructed from these values by plotting the regression coefficient (b) of each cultivar against its mean yield across all environments (entity mean performances).

Figure 1 represents the scatter diagram of regression coefficients plotted against entity mean performance. The horizontal line is the mean value of b across all sites. This value will always be 1.0 The vertical line is the grand mean (Y) of yields across all sites, years and cultivars. Cultivars which lie below b = 1 are more constant producers than those above b = 1, while those to the right of Y = 2,650 kg/ha, have higher than average yields (Figure 1).

Results and Discussion

All combinations of productivity and stability were found. 'Comet' and 'Marlate' had lower than average yields, but were more constant producers than average. 'Atlas' has low yields and was highly variable. 'Scott,' 'Raritan' and 'Redchief' had high yields and were more stable than average. 'Stoplight,' 'Guardian' and 'Delite' had high yields, but were highly variable. 'Midway' was average in both yield and stability.

It is interesting to note that the three most widely planted cultivars in Michigan ('Midway,' 'Guardian,' and 'Redchief') varied in their response to environmental variation (Figure 2). 'Midway' and 'Redchief' were steady, constant producers even in years when environmental means were low, while 'Guardian' did not do as well in low-yielding environments, but did much better in high yielding environments. This difference would not have been apparent if the cultivars had been contrasted using a coefficient of variation analysis.

The value of Finlay and Wilkinson's stability analysis is apparent since it takes into consideration both yield and constancy. It also allows dozens of cultivars to be evaluated together on one compact graph like Figure 1. Sta-

bility analyses should prove useful to many breeders and horticulturalists who want to condense years of data into a few meaningful comparisons.

Acknowledgments

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Reviewed Research Paper

Color Evaluation of Seventeen Strains of 'Delicious'

R. M. Crassweller,[1] J. Walker, and R. L. Shewfelt[2]

Introduction

Strain selection is a long term decision and can mean the difference between a profitable or unprofitable orchard. 'Delicious,' with over 100 different strains, provides the largest choice afforded commercial growers (4). In the selection process for new strains of 'Delicious' the primary criteria has been for improved or early coloring. In some areas, good red color can be a problem and local climatic differences can greatly affect its expression (1).

In the past, color evaluations of horticultural crops have largely been done on a visual basis (5). However, with increasing instrumentation it is now becoming more common to use automated colorimeters. Strachan (9) was among the earliest researchers to evaluate four red coloring limb sports in Canada. Dayton (3) in detailed anatomical studies reported differences between strains based on pigmentation characteristics in the epidermal cells of the fruit. Polesello and Gorini (8) further refined color determination by measuring twenty-six strains of Delicious with a Judd-Hunter color system. They broke the strains down into five groups based on lightness, hue, and saturation. While objective evaluations of color can eliminate variability and human bias, there is still a place for consumer acceptance panels (5, 6). The purpose then, of this work was to objectively and subjectively evaluate color and appearance of 17 strains of Delicious.

Materials and Methods

Ten fruit from each of the strains were harvested at 145 days after full bloom. All the strains were on M7 rootstock trained to a central leader system with annual pruning. The trees varied in age from 4 to 8 years and were growing in the variety block at the Georgia Mountain Experiment Station. Fruit color was evaluated using a Gardner XL-845 colorimeter adjusted with a pink standard (L =

[1]Former Extension Specialist, University of Georgia. Current address 102 Tyson Bldg., University Park, PA 16802.

[2]Research Associate and Assistant Professor, Departments of Horticulture and Food Science, University of Georgia, Georgia Experiment Station.

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