

Green Bean Variety Trial Safford Agricultural Center, 1998

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Abstract

Twelve green bean varieties were grown in a replicated small plot trial on the Safford Agricultural Center in 1998. Varieties were picked regularly during the growing season. Yields are shown in tabular form and also graphically to indicate how each variety performed throughout the season. Rapids produced the highest yield with a total over 1.3 tons per acre. Two other varieties, Shade and HMX 6999, also performed well with yields over 1.0 tons per acre.

Introduction

Green beans have been grown by homeowners in Graham County, but suffer from the salinity in the soil and irrigation water. As more area farmers are looking for crops to provide an alternative from the cotton monoculture, it was decided to evaluate several green bean varieties to find which ones would do best under our salty soil and arid growing conditions. This trial is one of many vegetable crop variety studies conducted at the Safford Agricultural Center in 1998.

Materials and Methods

This variety trial was performed on the Safford Agricultural Center at an elevation of 2954 feet above sea level. Bean seeds of the twelve varieties were planted in replicated small plot trials. Soil sulfur was worked into the beds and the plots were pre-irrigated to start the remediation process. Cultural practices and inputs are listed below in the crop history.

Crop History:

Soil type: Pima clay loam variant

Previous crop: Vegetables

Experimental design: Randomized complete block with 4 replications

Planting date: 3 April 1998 Rate: 75 lbs/ac

Fertilizer: 400 pounds/ac soil sulfur and 244 pounds/ac 16-20-0 applied 3/13, 100 pounds/ac urea applied 5/28

Irrigation: Watered up, furrow irrigated 9 times (ca. 36 inches of water)

Herbicide: None

Insecticide: None

Harvests: 29 July, 12 August, 31 August, 15 Sept and 23 Sept

Harvests were done manually and fruit was weighed and pod lengths were measured. Plant populations and plant heights were also measured and a visual chlorosis rating was made.

Analyses from saturated paste extracts from the experimental field and a typical water sampling from the irrigation well are included below:

Sample	pH	Electroconductivity	Total Dissolved Solids	ppm Na	Estimated SAR
Soil 0-2 inches	7.81	6.42	4109	1020	9.9
Soil 6-8 inches	8.34	1.86	1190	322	6.0
Well water	7.53	2.06	1318	366	7.35

Results and Discussions

Beans are very salt sensitive (1) with a salinity threshold value for electroconductivity of 1.0 and a slope of 19. Fortunately they have some tolerance at germination with an EC of 8.0 being the point of 50% emergence. Using the formula $Y_r = 100 - B(K_e - A)$, where Y_r is the relative yield, A is the salinity threshold, B is the slope or percent yield decrease per unit salinity increase above the threshold and K_e is the electroconductivity of the saturated soil paste, the yield potential for beans under field conditions can be calculated. With these values it is determined that $Y_r(0 - 2") = -2.98\%$ and $Y_r(6-8") = 83.7\%$. This shows the importance of planting deep and irrigating every other row to push the salts away from the plant roots.

Table 1 gives the yield data by variety across all picking dates and the final yield in tons per acre. Data from the top six varieties was also plotted in Figure 1 to show how a given variety performed during the picking season. Rapids and Hialeah were the earliest varieties providing harvestable beans 117 days after planting or at 1976 heat units (HU). Rapids had an especially heavy first crop with a significant drop in the second pick. Shade and HMX 6999 started almost 2 weeks later and produced heavily for the first two or three pickings. The overall yield of Rapids was 1.34 tons per acre or 26.8 cwt per acre. This yield is about 81% of the US standard yield (2), which ties quite well with the estimated relative yield from electroconductivity measurements in the rooting zone.

Table 2 shows plant populations and growth characteristics along with chlorosis ratings. The optimal plant population would be around 60,000 plants per acre or about 3 inch spacing on a 36 inch bed for bush beans and it is felt that the plant populations in this study were within the acceptable range. Plant heights seemed low which may be attributed to the soil salinity stunting plant growth. Pod lengths varied slightly from variety to variety, but were not sufficiently different to cause marketing problems. From the chlorosis ratings, with a rating of 4 not showing chlorosis, only a few of the varieties showed outward signs of salt stress.

The market price for green beans would dictate whether this crop would be economically successful in the area. An active soil remediation program would be helpful to increase yields.

References

1. Maas, E.V. 1986. Salt tolerance of plants. Applied Agricultural Research Vol. 1, No. 1, pp. 12-16. Springer-Verlag New York.
2. Lorenz, O.A. and D.N. Maynard. 1988. Knott's Handbook for vegetable growers, third edition. Wiley-Interscience Publication, New York.

Table 1. Sequential harvest weights and total yield values for green bean varieties grown at the Safford Agricultural Center, 1998.

Variety	7/29	8/17	8/31	9/15	9/23	Total #	Tons/ac
Rapids	2.38 a ¹	0.38 bcd	1.28 b	1.10 b	0.23 abc	5.35 a	1.34 a
Shade	--	0.75 ab	1.35 b	1.80 a	0.45 a	4.35 ab	1.09 ab
HMX 6999	--	1.05 a	1.93 a	0.83 bc	0.28 abc	4.08 b	1.02 b
Derby	--	0.95 a	0.98 bcd	0.68 cd	0.28 abc	2.88 c	0.72 c
Sonata	--	0.33 cd	1.03 bc	0.53 cde	0.20 bc	2.08 cd	0.52 cd
Hialeah	0.83 b	0.20 cd	0.50 cde	0.15 ef	0.05 c	1.73 cde	0.43 cde
Espada	--	0.18 cd	0.45 de	0.80 bc	0.18 bc	1.60 de	0.40 de
Golden Rod Wax	--	0.45 bcd	0.33 e	0.33 def	0.15 bc	1.25 de	0.31 de
HMX 5991	--	--	0.05 e	0.43 c-f	0.45 a	0.93 de	0.23 de
Probe	--	0.15 cd	0.13 e	0.15 ef	0.35 ab	0.78 e	0.19 e
Nugget (wax)	--	0.35 cd	0.18 e	0.18 ef	0.08 c	0.78 e	0.19 e
Prosperity	--	0.28 cd	0.33 e	0.10 f	0.05 c	0.75 e	0.19 e
Average	1.61	0.46	0.71	0.59	0.23	2.21	0.55
LSD(05)	0.41	0.38	0.57	0.42	0.23	1.19	0.30
Days from planting	117	136	150	165	173		
HU(55/86°F)	1976	2400	2737	3090	3357		

1. Values within a column followed by the same letter are not significantly different at the 95% level of confidence using Duncan's Multiple Range test.

Table 2. Plant populations and physiological characteristics for green bean varieties grown at the Safford Agricultural Center, 1998.

Variety	Plants/ac	Plant Height inches	Pod Length inches	Chlorosis Rating ¹ May 28,1998
Rapids	72963 bc ²	8.0 ab	4.68 a-d	4
Shade	87120 a	8.0 ab	4.55 b-f	4
HMX 6999	86394 a	7.8 bc	4.35 fg	4
Derby	82764 ab	9.0 a	4.65 a-e	4
Sonata	54450 de	8.0 ab	4.83 a	4
Haileah	72237 bc	7.8 bc	4.75 ab	4
Espada	64614 cd	8.5 ab	4.65 a-e	1
Golden Rod Wax	67881 c	6.8 cd	4.43 ef	2
HMX 5991	88935 a	6.5 d	4.50 c-f	4
Probe	67881 c	8.0 ab	4.48 def	4
Nugget (wax)	80949 ab	6.8 cd	4.18 g	2
Prosperity	50094 e	8.8 ab	4.73 abc	4
Average	73023.5	7.8	4.57	3.4
LSD(05)	12515.55	1.01	.226	--

1. Chlorosis rating 1= bad, 4 = none.

2. Values within a column followed by the same letter are not significantly different at the 95% level of confidence using Duncan's Multiple Range test.

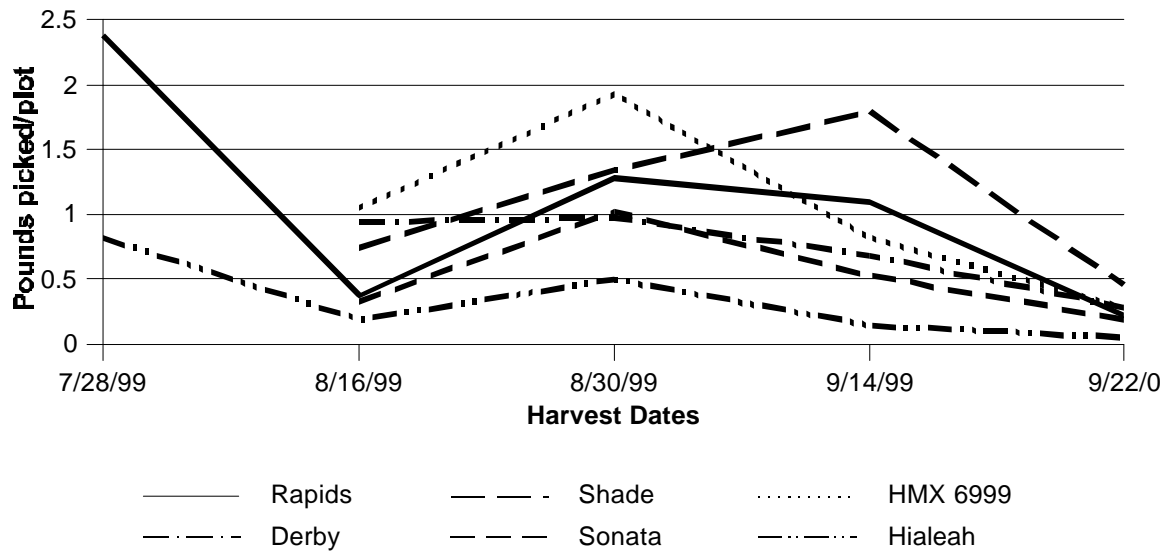


Figure 1. Harvest weights by variety across picking dates for the top six varieties of green beans in a variety study at the Safford Agricultural Center, 1998.