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Moisture Stress Reduces Bush Bean Yields

Several varieties and breeding lines of bush beans were planted on June 5, 1979, at the OSU Vegetable Research Farm in two blocks. One block received normal irrigation during the season; the other was not irrigated before and during the major blossoming period. Seeds were planted to give a stand averaging seven to eight plants per foot of row. Rows were 36 inches wide. Fertilizer was banded at planting to supply about 50 pounds N, 150 pounds P_2O_5, and 50 pounds K_2O per acre. Date that first blossoms opened for the nine selected varieties ranged from July 19 to July 23, 44 to 48 days after planting. Average maximum temperatures (^{o}F) for five-day periods were: July 11-15 = 81^{o}, July 16-20 = 97^{o}, July 21-25 = 83^{o}, and July 26-30 = 84^{o}.

The "normal (N)" irrigation treatment block received 7.5 inches of water in six irrigations (June 25-.70 inches, July 5-1.05, July 12-1.05, July 19-1.40, July 26-1.40, and July 28-1.75 inches), while the "stress (S)" treatment received 3.5 inches of water in three irrigations (June 25-.70 inches, July 5-1.05, and July 28-1.75 inches). The stress treatment, therefore, received no irrigation from July 6 to July 28. Harvest was on August 8, 64 days after planting, when 25 plants per plot were randomly selected and total plant weight plus pods, pod weight, and number of pods per plant were determined. There were four replications of each variety in each of the two moisture treatment blocks. Percentages of pods of sieve sizes 1-4 also were obtained for each variety or breeding line.

Data in Table 1 show that in the stress

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treatment, compared to the normal irrigation treatment, reduction in plant weight plus pods ranged from 17 to 38 percent for the nine varieties with an average reduction of 31 percent. However, moisture stress reduced plant weight more than pod weight with an average reduction of 42 percent in plant weight and 15 percent reduction in pod weight. Number of pods per plant averaged 15 percent less for OSU 4117 and Red Kidney to 34 percent lower for Oregon 1604 and OSU 4091-3 under the stress condition compared to normal irrigation. Percentage of pods sieve sizes 1-4 in the stress treatment was 54 compared to 71 percent in the normal treatment indicating that pods were more advanced in maturity under the stress treatment. Because of this, weight of pods did not differ for the normal and stress treatments for some varieties although the number of pods per plant was lower in the stress treatment. There were more misshapen pods under the stress condition and measurement of pod length of sieve size 4 pods indicated an average reduction of 8 percent for five varieties from the stressed condition.

Electrical resistance gypsum moisture blocks were installed at 6, 12, and 18-inch depths and read at two to three-day intervals from July 3 to August 6. Moisture block readings shown in Figure 1 indicated readings ranging from about 16 to 22 at the 12-inch depth during first bloom in the moisture stress treatment, compared to readings of 130 to 165 for the normal irrigation treatment. These readings indicated that about 85 to 90 percent of the available soil moisture was depleted at bloom at the 12-inch depth in the stress treatment. About 40 to 50 percent or less was depleted at the 12-inch depth in the normal irrigation treatment.

Although there appear to be some differences in responses of varieties and breeding lines to moisture stress during blossoming in this experiment, further work is planned. Other researchers have shown that moisture stress during flowering period is the most critical or sensitive stage for reducing pod set and yield of bush beans.

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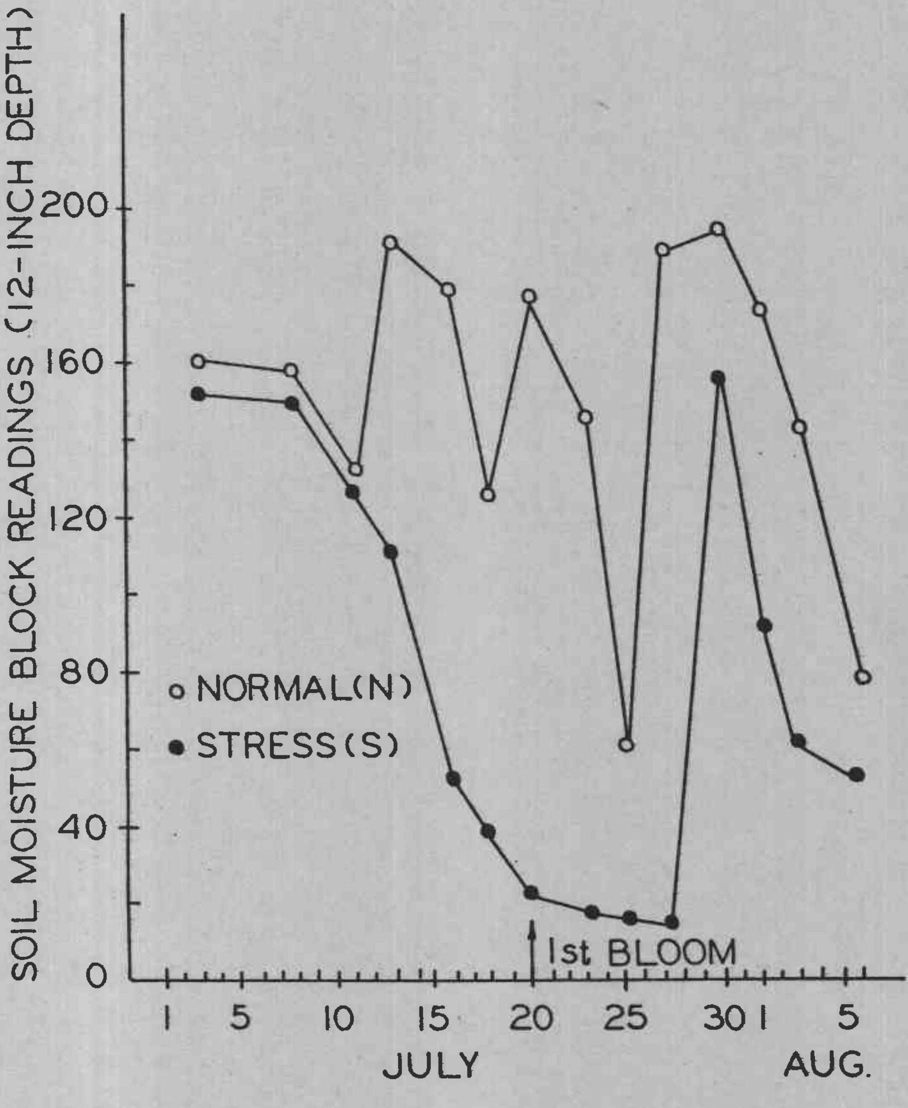
Table 1. Effects of irrigation treatments on bush bean varieties and breeding lines, Corvallis, 1979

Variety or breeding line	Irrigation treatment	Weight per plant (lbs): Total (plants and pods)	Weight per plant (lbs): Pods	No. pods/ plant	% 1-4 sieve
1) Oregon 1604	Normal (N)	.39	.18	17.3	54
	Stress (S)	.26	.15	11.4	32
2) Galamor	N	.32	.09	12.5	96
	S	.23	.09	9.4	83
3) OSU 4091-3	N	.37	.18	17.5	77
	S	.23	.13	11.6	50
4) OSU 4117	N	.33	.17	14.4	36
	S	.21	.13	12.2	35
5) OSU 4886	N	.36	.14	16.4	93
	S	.23	.11	12.3	65
6) Stretch	N	.32	.12	9.9	52
	S	.20	.10	8.0	38
7) Gem Wax	N	.24	.08	7.7	91
	S	.20	.08	6.5	78
8) Romano 14	N	.28	.12	9.4	--
	S	.18	.08	7.4	--
9) Red Kidney	N	.30	.12	9.5	--
	S	.20	.10	8.1	--
Avg. (all varieties)	N	.32	.13	12.7	71
	S	.22	.11	9.6	54

Figure 1. Effect of two irrigation treatments
on soil moisture block readings



Priming of Parsley Seed

Seed germination is a critical stage in the production of vegetable crops because of the vulnerability of the germinating seeds to environmental stress such as high or low temperatures, drought or water-logging. Damage from such stress often could be avoided if the time the seeds are in this vulnerable stage were reduced.

One way of reducing the time required for germination is by pre-germinating seeds before planting, but such a technique presents the problem of sowing seeds after the delicate radicle (seedling root) has emerged. Another way is by seed priming. The late Walter Heydecker of the University of Nottingham pioneered in this field. He suggested that seed germination could be split into two stages. During the first stage, commencing with the imbibition of water by the seed, existing enzyme systems are activated, food reserves are mobilized, and new enzymes and other biochemicals are synthesized. In short, the seeds are prepared for the second stage of germination when the radicle elongates and active growth begins. The basic goal of his priming research was to find techniques that would permit seeds to complete the first stage under controlled conditions and then to stop the germination process temporarily just before radicle emergence. The seeds so primed should germinate rapidly once sown in the field or greenhouse. In addition, the seed priming should improve the synchronization of germination because the entire population of seed has been stopped at the same point in the germination process. What's more, Heydecker theorized, that because the initial germination processes are irreversible, primed seed might be re-dried and still retain the advantage of priming when re-imbibed.

His research explored several techniques of priming. One was to use a solution of specific osmotic potential to control the amount of water imbibed by the seeds. Dry seeds have strong suction force of about 1,000 atmospheres (expressed as -1,000 bars, roughly a measure of the seeds potential to absorb water). The suction force of the seeds declines rapidly during imbibition and reaches -7.5 to -15 bars about the time of radicle emergence. If the suction force for a seed drops to -10 bars just before radicle elongation and this seed is in a solution with an osmotic potential of -10 bars, the seed will not absorb any more water and radicle emergence will be prevented.

One of the more commonly used chemicals for adjusting osmotic potential for seed priming is polyethylene glycol 6000 or PEG-6000 (the 6000 denotes the approximate molecular weight of the material). This inert compound gives a true osmoticum, i.e., it is not absorbed by the cells (unlike common salts such as NaCl, KNO_3, and K_2PO_4 that have also been used for priming).

One vegetable crop that might benefit from seed priming is parsley. Sown

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during mid-summer, the seeds normally take about 14 days to germinate. Stand establishment can be a problem because during the long time required for germination they are very susceptible to damage from drying, high temperatures, and soil-crusting.

The following study was designed to provide basic data regarding the efficacy of, and specific requirements for the priming of parsley seed with PEG-6000. Treatments included three osmotic potentials (-10, -12.5, and -15 bars), three durations of priming (1,2, and 3 weeks), and two post-priming treatments of the seed (sown immediately after priming and re-dried before sowing), and one untreated control. The treatments were replicated four times in a randomized complete block design.

The seeds were primed in lots of 100 in Petri dishes on three layers of filter paper that had been dipped in the appropriate PEG-6000 solution and allowed to drip drain for about 15 seconds. The Petri dishes were sealed in large air-tight plastic freezer boxes which were kept at 15°C. After priming, the seeds were rinsed first in 1:10 household bleach solution to destroy surface mold and then three times in distilled water. Afterward, half the priming treatments and the control were immediately sown in flats of vermiculite and placed in the greenhouse (temperatures 22 to 28°C). The other half of the treatments were dried for 24 hours on the top of a lab bench (temperatures 20-25°C and relative humidity 50-60%) and sown the following day.

Results presented in Table 1 show that the rate of germination, expressed as days after sowing to 50 percent germination, was significantly reduced by all priming treatments. Seeds primed at -10 bars for 3 weeks germinated 50 percent or 7 days faster than the control. Re-drying the seeds did not reduce the effects of priming. In fact, the re-dried seeds seemed to germinate slightly quicker.

Table 1 also shows that priming with PEG-6000 did not significantly affect germination percentage. No phytotoxicity was apparent in any of the priming treatments.

Further research is planned to study the effects of different priming chemicals, a lower range of osmotic potentials, longer periods of priming, and the storability of primed seed after re-drying. In addition, seeds will be sown in the field to determine benefits of priming under field conditions.

References:

Heydecker, W. 1978. 'Primed' seeds for better crop establishment. Span 21: 12:12-14.

Heydecker, W., J. Higgins and R. L. Gulliver. 1973. Accelerated germination by osmotic seed treatment. Nature 246:42-44.

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Table 1. Effect of priming and post-priming treatment on the rate and percentage of germination of parsley

Osmotic Potentials (bars)	Duration (Weeks)	Post Prime Treatment	Days to 50% Germination	Final % Germination
-10.0	1	planted	10.0	76
		redried	9.0	74.3
	2	planted	9.0	71.3
		redried	8.0	77.0
	3	planted	7.5	80.0
		redried	7.3	75.5
-12.5	1	planted	11.0	73.8
		redried	9.0	75.5
	2	planted	9.5	75.5
		redried	8.8	76.8
	3	planted	9.8	68.3
		redried	8.0	78.8
-15.0	1	planted	11.0	75.5
		redried	9.3	77.3
	2	planted	10.8	73.0
		redried	9.0	75.5
	3	planted	10.0	70.0
		redried	8.8	71.5
Control (untreated)			14.3	72.0
LSD .05			0.8	NSD
.01			1.1	

Time of Topping Affects Yields of Sweet Corn

'Jubilee' sweet corn was planted at the Oregon State University Vegetable Research Farm on May 24, 1979, and grown with standard weed control, fertilizer, and irrigation practices. Row spacing was 36 inches with plants thinned to six-inch spacing in the row for a population of 29,000 plants per acre.

Individual plots were topped by hand with pruning shears at the following times: (1) at full silk (silks emerged and about 50 percent turning slightly brown on August 7, 75 days after planting), (2) one week after full silk, and (3) two weeks after full silk. The upper portion of stalks was removed so two leaves remained above the top ear. Also included was a check treatment with plants not topped. Treatments were replicated eight times. All plots were harvested September 7, 106 days after planting, when moisture content of kernels averaged 73 to 74 percent.

Data in Table 1 show that topping at full silk, and one and two weeks later, reduced unhusked and husked graded yields averaging 14, 10, and 7 percent, respectively, compared to the check treatment not topped. Husked weights of individual graded ears were lower from topping treatments and average number of ears per 100 plants was lower than when plants were not topped.

These results are in agreement with earlier work which indicates that a decrease in yield of 6 to 10 percent might be expected when 'Jubilee' sweet corn is topped a week to 10 days after full silk. This potential yield reduction should be weighed against the potential benefits provided by topping, namely, reduction in lodging, ease of moving irrigation pipe, and more efficient harvesting.

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Table 1. Effect of time of topping on yields of 'Jubilee' sweet corn. Corvallis, 1979

	Yield - tons/A			
Time of topping	Unhusked total	Husked graded	Husked graded ear weight lbs/ear	No. graded ears/100 plants
At full silk	10.0	6.4	.58	82
One week after full silk	10.6	6.6	.59	84
Two weeks after full silk	11.1	6.8	.61	83
Check - No topping	11.7	7.4	.62	89

News and Notes

The Many Ways of Making Sweet Corn Sweet

Sweet corn growers have always had many varieties to choose from. Now there are not only many different varieties but also several types of sweet corn. Cross pollination must be considered when different types are planted adjacent to one another. Below is a simplified list of the five types of sweet corn available and some examples of the varieties of each type.

The sweet corn types 2 and 4 listed below must be isolated from other types of sweet corn and also from each other. Pollen from other types will make the kernels of types 2 and 4 starchy and no different from field corn. If a super sweet pollinates ADX or vice versa, the kernels will be starchy. Also, pollen from type 2 or type 4 will turn normal sweet corn (type 1) starchy.

Extra sweet types 3 and 5 will develop normal sweetness when pollinated by type 1 sweet corn. Pollen from types 3 and 5 does not affect type 1.

Isolation distances of 700 feet or more will give complete isolation but may be impractical. A distance of 250 feet will give some contamination but not enough to materially affect quality. Wind direction should be considered when arranging isolation. Barriers or border rows are helpful. Where posible, use the "isolation" that can be provided by time of maturity. At minimum there should be a 14-day difference between the maturities of the different types to be sure of providing time isolation.

Penn State Hort News

Type	
1. Normal Sweet	Jubilee, Stylepak, Silver Queen, Rapidpak, and most hybrid varieties
2. Super Sweets	Early X-TRA Sweet, Illinois X-TRA Sweet
3. Synergistic or Sugary Super Sweets	Sugar Loaf, Honeycomb
4. Gene combination such as ADX Sweets	Pennfresh ADX
5. Modified Sugary or EH Sweets	Candy Corn EH, Mainliner EH, Golden Sweet EH, Tender Treat EH

Useful Publications:

Vegetable Production Costs--Robert L. Christianson, Robert W. Martin, and Gary Lucier. Research Bulletin 658, September, 1978, Massachusetts Agricultural Experiment Station, University of Massachusetts, Amherst, Massachusetts.

This is a publication useful in assisting growers to determine production costs and farm budgeting.

Small-Farm Costs and Returns: Pick-Your-Own-Vegetables--P. J. Kirschling and G. H. Sullivan. Station Bulletin 223. Department of Horticulture, Agriculture Experiment Station, Purdue University, West Lafayette, Indiana.

Curly Top Identification Handbook: Nine Crops--Burton J. Hoyle. Division of Agriculture Sciences, University of California, Berkeley, CA. Sale publication 079. Sale price. $4.

The publication is useful in identifying curly top symptoms on snap beans, dry beans, cantaloupes, cucumbers, bell peppers, spinach, sugar beets, tomatoes, and watermelons, especially for growers in eastern Oregon where newly irrigated lands are being developed and new vegetable crops are being considered.

Also, as a general reference, the following crops have been listed by OSU plant pathologists and Dr. P. E. Thomas, curly top researcher at the Irrigated Vegetable Research and Extension Center at Prosser, Washington as being: 1) UN= unaffected; 2) SR=susceptible with resistance available but not necessarily in commercial varieties; 3) CS=carrier of the virus but no symptoms apparent; 4) SU=susceptible.

Asparagus	UN	Collards	UN	Peas	UN
Beans, Snap	SR	Sweet Corn	UN	Peppers	SU
Beans, Lima	UN	Cucumber	SR fairly	Pumpkin	SR
Beans, Romano	SR	Eggplant	SU	Radish	CS
Table Beets	SR	Endive	UN	Rubarb	SU
Chard	SU	Escarole	UN	Rutabaga	CS
Broccoli	CS	Kale	CS	Salsify	UN
Brussel Sprouts	CS	Kohlrabi	CS	Spinach	SR
Cabbage	CS	Leek	UN	Squash, winter	SR
Chinese Cabbage	CS	Lettuce	UN	Squash, summer	SR
Cantaloupes	SR slightly	Mustard	CS	Tomato	SR
Carrots	UN	Okra	SU	Turnip	CS
Cauliflower	CS	Onions	UN	Watermelon	SR
Celery	UN	Parsley	UN		

No monocots are known to be affected. In some cases where susceptibility is indicated a good crop can be produced before the symptoms severely injure the plant. An example of this in summer squash would be zuchinni, where good yield can be obtained, whereas, crook neck is very susceptible.

New Faculty:

Raymond D. William will join the OSU Horticulture Department in mid-December as Extension Horticultural Weed Specialist. Ray received his B.S. from Washington State University and then had the opportunity to work in Ceylon as a participant of the International Farm Youth Exchange program. After graduate school at Purdue University he received a 2-year Foreign Area Fellowship to conduct the Ph.D. dissertation at the Federal University of Vicosa in Brazil. He then took the position of training officer and crop management specialist at the Asian Vegetable Research and Development Center in Taiwan. Since 1977, he has been at the University of Florida as an Extension Specialist in the Vegetable Crops Department.

Art Badenhop received his Ph.D. from Ohio State University in Horticulture/Food Science. He then did postdoctoral work at Cornell University. Badenhop has served as an Extension Specialist for the University of Georgia and Purdue University. He recently came to Oregon State University and is an associate professor in the Food Science Department with an emphasis as the Extension Specialist in fruit and vegetable processing.

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