Recommendations for Commercial High-Density Snap Bean Production

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Prepared by N. S. Mansour, Extension vegetable crops specialist,
and H. J. Mack, professor of horticulture,
Oregon State University

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Recommendations for Commercial High-Density Snap Bean Production

There is increasing interest in high-density snap bean production in Oregon, especially by growers who have mechanical harvesters for the crop.

Field choice and soils

Fields should be rectangular for efficient machinery operation, of uniform soil type, and as level as possible. They should not be surrounded by high trees or near residential areas. Planting in open areas allows improved air drainage, minimizes mold problems, and allows aerial applications of pesticides.

Soils should be well-drained, fertile, and free of rocks, since the high-density harvester picks rocks along with beans. Well-drained soils warm better than poorly drained soils ,and permit more uniform germination and emergence.

Field preparation

Turn under or incorporate crop residues so that the seedbed is smooth and free of clods or plant debris. Use a land plane if necessary. Preirrigate the field if needed, before the last seedbed operation, so that seed can be planted into moisture. Remove all wheel tracks and leave a uniform, well aerated seedbed with a firm surface to conserve moisture and allow uniform planting depth. A field cultivator, spike-tooth harrow, and cultipacker (pulled in tandem), in this order, will help prepare a good seedbed.

Fertilizer and lime

Lime and fertilizer rates should be based on soil test results. If the pH is below 5.5, apply lime in the fall, before or during field preparation. In general, fertilizer recommendations for nitrogen, phosphorus, and potash (N, P, K) are as follows:

FERTILIZER RECOMMENDATIONS FOR HIGH DENSITY SNAP BEAN PRODUCTION

Row spacing (inches)	Amount of nutrient/acre*		
	N	P (P_2O_5)	K (K_2O)
	Pounds	*Pounds*	*Pounds*
36 inches	40-100	60-150	0-120
15 inches	60-125	100-250	0-150
7 inches	80-150	150-375	0-180

* For metric conversion, 1 acre = .405 hectares, 1 inch = 2.54 centimeters, 1 pound = .453 kilograms; 1 hectare = 2.47 acres, 1 meter (100 centimeters) = 39.37 inches, 1 kilogram = 2.2046 pounds.

Band the fertilizer at planting time, especially phosphorus. Where the total nitrogen and potash requirement exceeds 0.1 ounce per lineal foot (equal to 300 pounds per acre in 12-inch rows), broadcast the excess fertilizer before the final seedbed preparation. Place the total phosphorus application in the band, at a 2-inch x 2-inch spacing in relation to the seed, regardless of the spacing between rows. Ammoniated phosphate (1:1, 1:2, or 1:3 ratio) generally improves phosphate uptake by plants.

In high-density plantings, it is necessary that banded fertilizer be calculated on the basis of ounces or grams per lineal foot of row as compared with pounds per acre for conventional plantings. Either liquid or dry fertilizer can be used. In 12-inch rows, there would be three times the length of row per acre as with 36-inch row spacings. This would require at least two times the rate of phosphate, especially in early plantings. Doubling of the phosphate rate per acre when spacings are changed from 36 to 18 inches between rows would keep the lineal phosphate rate the same. The following table shows lineal foot concentrations at several spacings and fertilizer rates per acre. Note that three times as much fertilizer per acre may be banded without danger of crop injury when 12-inch spacing between rows is used instead of 36-inch spacing.

High-density planter with fertilizer banding attachment.

FERTILIZER RATE PER LINEAL FOOT OF ROW FOR VARIOUS TOTAL APPLICATIONS PER ACRE

Total application per acre	Rate per lineal foot, by row spacings			
	36 in. (14,520*)	18 in. (29,040*)	12 in. (43,560*)	6 in. (87,120*)
	Ounce	*Ounce*	*Ounce*	*Ounce*
100 pounds	0.11	0.06	0.04	0.02
150 pounds	0.17	0.08	0.06	0.03
200 pounds	0.22	0.11	0.07	0.04
250 pounds	0.28	0.14	0.09	0.05
300 pounds	0.33	0.17	0.11	0.06

* Lineal feet per acre. See fertilizer recommendations table for metric conversion.

Supplementary application of nitrogen in an emergency situation can be applied by air. Ammonium nitrate would be the easiest to apply. To avoid burning the plants, apply no later than the stage of full flower bud expansion (before flower opening), when foliage is dry, just before an irrigation. In general, 30 to 50 pounds per acre would be maximum. Use care in applying supplemental nitrogen, since this may cause blossom drop and excessive vegetative growth.

Planting

Only a few new planters have the capability of planting rows closer than 12 inches apart. Several conventional planters are available which could be mounted in tandem to plant 6- to 12-inch row spacings. Examples are: The International Harvester 185, and the John Deere Flexi Planter, which are two-plate type planters, and the Stanhay Jumbo, a belt planter. Two new air planters are available, the Cyclo Planter made by International Harvester, and the White Plant/Aire Planter made by White-Oliver. The John Deere Max-Emerge is a new plateless type. Special fertilizer banding application equipment will have to be obtained for these planters. Some companies offer this equipment as part of their line of farm implements.

Planters that have the capability of being put close enough together on one tool bar, and at the same time singulating bean seeds, include the Stanhay Mark IV planter and the Winslow Pacific Centra-Flo Planter. The use of a grain-drill is discouraged.

Precision high-density planter capable of good seed singulation.

Example of high-density beans which have been properly singulated at planting.

Recommended plant populations are 150,000 to 200,000 plants per acre, with 175,000 plants per acre (approximately 36 square inches per plant) being about the ideal population. Practical considerations may dictate spacing between rows. Research shows, however, that spacings between rows should be from 6 to 16 inches, and that under constant populations, the more nearly square the plant spacing, the greater the yield advantage. Some of the advantages of high-density bean planting could be lost when spacings between rows are 18 to 24 inches or wider.

It is important that seed size be considered at planting time, since bean varieties grown in Oregon vary greatly in seed size. As an example, Early Gallatin bean seed is relatively large (about 1,350 seeds per pound), whereas seed of Asgrow 290 and Oregon 1604 are small (as many as 2,200 seeds per pound). Because of this, seeding rates to obtain 175,000 plants per acre could range from 80 pounds of seed per acre to 145 pounds of seed per acre, assuming 100 percent germination! Seed quality is also important. This is reflected in percent germination and plant vigor. Only seed having a minimum of 80 percent (prefer 90 to 95 percent) germination should be used. Growers should also use the seed lots with highest germination early in the season when the soils are cold and good stands are more difficult to obtain.

Weed control

Proper soil preparation is important for effective chemical weed control. Three materials are used widely in bush bean weed control. Treflan (Trifluralin) and Eptam (EPTC) are incorporated as soon as possible after application and they should be incorporated shallowly, about 2 inches for Treflan, 2 to 3 inches for Eptam; deeper (4 to 5 inches) if quackgrass or nutgrass is a problem. Use the higher allowable rates with deep incorporation, due to the increased dilution. Adequate moisture should be available to activate the herbicide and to germinate the weed seeds. Preemerge (Dinoseb amine) is applied after planting, but before emergence of the crop to control mustard, wild radish, night shade, groundsell, and shepherds purse (which are not adequately controlled by Treflan or Eptam). On heavy, textured soils, it should be applied just before seedling emergence. On sandier soils, particularly when the soils are warm and emergence is expected to be rapid, the Dinoseb amine should be applied as soon as possible after planting. Temperature is important in Dinoseb rate determination. Consult the current *Oregon Weed Control Handbook* (OSU Book Stores, Inc.) for rates and other pertinent information, or ask your Extension agent.

With proper weed control, no cultivation should be necessary. If chemical weed controls fail, consider cultivating the field even at the expense of destroying the bean rows in the tractor wheel track. No post-emergence weed control materials are registered for beans now.

Irrigation

Availability of adequate irrigation water and equipment is essential. In general, growers should have available a pumping capacity of 6 gallons (about 2½ liters) per minute, per acre of beans. Irrigate on the basis of the soil moisture under the plants in the row, which can be determined by soil sampling or by use of moisture blocks. Frequency and amount of irrigation for high-density bean fields depends on soil type, soil moisture reserves, seasonal and climatic conditions, and stage of growth. High-density bean fields should not be stressed for moisture and it is anticipated that high-density bean fields might require one additional irrigation over conventionally planted fields. Four to six irrigations, supplying 10 to 12 inches of water per acre are suggested. Irrigation may be needed sooner because of the increased plant population. Keep soil moisture above 60 percent field capacity at 12-inch depth. Irrigate just before plant bloom to bring soil to field capacity so that beans could have access to adequate moisture during blooming and pod set. This reduces the need for irrigation during the bloom period and minimizes the infection and spread of gray mold or write mold. Apply the next irrigation after the blossoms have dried and pods begin to enlarge, unless available soil moisture is depleted or the condition of the bean

Wheel roll irrigation system.

plants or roots make it necessary to irrigate sooner. Wheel roll systems provide uniform irrigations with minimum labor.

Pest control

Seed and foliar fungicides are necessary to control several bean diseases. Research shows that the effect of root rot can be minimized when the soil directly under the row is loosened with a soil chisel just before planting. Use care, however, to insure uniform seeding depth, and to see that soil does not crack along the seed row after planting. Rotation to not more than 1 out of 3 years of legumes is helpful to prevent many diseases. A number of fungicides are available to prevent mold growth. Bloom is a critical time for application of most materials. Consult the *Pacific Northwest Disease Control Handbook* (OSU Book Stores, Inc.) or your Extension agent for proper application times and rates of the materials necessary for mold control.

Seed, soil, and foliar insecticides are necessary to control a number of insect problems. Insecticide applications may be needed to control symphylans, seed maggots, aphids, and *Diabrotica* (Western spotted cucumber) beetles, and under some conditions, cutworm infestations anytime during the season. Slugs may also be a problem. Consult the *Pacific Northwest Insect Control Handbook* (OSU Book Stores, Inc.) or your Extension agent for specific controls, pesticides, and rates.

Harvesting

Processors determine harvest date and schedule and harvesting should commence at a time when hand-sampling indicates the sieve size distribution is that which the processor requires. High-density plantings may mature a day or two later than conventional plantings in some situations. The Chisolm-Ryder Multi-D and FMC 85 B bean harvesters are two currently available U.S.-manufactured machines for successfully harvesting high-density snap beans. Correct adjustment of the machines is imperative. Operators must be continually alert to changes in harvester operation and harvest conditions or an excessive loss of beans, an exces-

High-density bush bean harvester.

sive number of clusters, or broken beans and a trashy product may result. The machines operate most efficiently while harvesting in the same direction as the rows and when plants are upright with the pods carried high in the plant. Current varieties having a compact bush habit have been harvested successfully by these machines. The field should be smooth and flat, and free from rocks, clods, and weeds. Manage irrigation before harvest carefully to reduce pod breakage. Deliver beans as soon after harvest as possible.

General comments

Production costs for high-density plantings of bush beans will be greater due to increased cost of seed, fertilizer, and machinery. It is anticipated that a 25 to 35 percent increase in yield of beans of equivalent grade to conventionally planted beans will be possible where good cultural practices are used. Dockage for broken beans generally will be higher than from conventional harvesters. The amount of dockage, however, is greatly influenced by the grading procedure used by individual processor, by cultural practices, irrigation practices, and varieties used. Percentage of broken beans would not be higher from high-density plantings than conventional plantings where high-density harvesting equipment is used. It is especially important to exercise good management from the time of seedbed preparation to harvest and delivery of the crop to the processor.

In naming brands of equipment, the authors do not imply recommendation by brand name, nor is criticism implied of other equipment not named.