Green Bean Production

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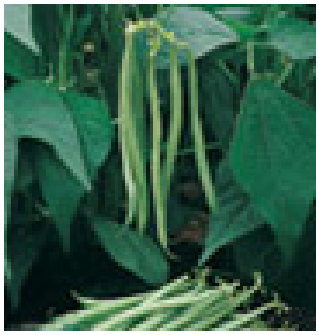

Green beans are a warm weather crop but they require a short growing season. The major production in the United States is located in Wisconsin, western New York, and Oregon. They have been grown in quantity all along the Atlantic coastal plain and in the Midwest from Arkansas up through Minnesota and Wisconsin, generally the eastern Corn Belt. A problem we have in the Great Plains occasionally is the lack of moisture for successful production. Also, temperatures may be too high during certain parts of the growing season. Thus, irrigation is a necessity for long term successful production. The largest risk for green bean growers is a stable market with good prices. A grower must establish a market before planting which may be wholesale, such as through grocery stores or institutions, or retail through farmers markets or roadside stands. Production risks are weather related, mainly high temperatures in July and wet weather interfering with harvest or causing pod diseases.

Management of successful green or snap bean production involves two phases: 1) scheduled planting to maintain continuous supply through the harvest period, and 2) timely harvesting when beans are peak quality.

For up-to-date information on varieties and pest management obtain FG-600, titled "Midwest Vegetable Production Guide for Commercial Growers", from your local county extension office or from Extension Distribution Center, Printing and Publications Bldg., Iowa State University, Ames, Iowa 50011. You may also access the publication online my using the link on the ISU commercial vegetable homepage at: http://www.public.iastate.edu/~taber/Extension/index.htm

Soil Site Selection

Green beans can be successfully grown on sandy loam, or coarser, to silt loam soils. Sandy soils will allow earliness but irrigation is essential. The soil should be well-drained and level for ease of mechanical harvesting. A heavy soil, such as a silty clay loam, that is poorly drained is not suitable for green bean production because root rot could be a big problem. Green beans will drop their blossoms under wet soil conditions.

Green beans are shallow rooted with most of the root absorbing surface in the top foot of the soil so irrigation is necessary for top quality production, particularly in the western regions of the

state. Bean rotation should follow a grain crop, such as wheat or corn. Do not follow legumes as disease problems, particularly *Pythium*, are prevalent. Generally, three years of non legume crops between bean plantings is recommended. Further, do not plant fall beans behind a spring crop of broccoli or cauliflower.

Fertilization

The soil pH should be between 6.0 and 6.5. In the western part of the state, soil pH may approach 8.0, reducing zinc (Zn) availability. Micronutrient availability can be tested by plant analysis coupled with soil tests. Green beans are a low user of nutrients and do not require high amounts. If beans follow corn, phosphorus (P) and potassium (K) levels are usually ample for top production. A maintenance recommendation might be 50 pounds of P_20_5 (phosphate) and 50 pounds of K_20 (potash) per acre broadcast and disked in prior to planting. **Or**, you could apply the fertilizer in a 3 X 2 band at seedling. Be extremely careful to check equipment as beans are highly susceptible to soluble salt injury, a result of placing the fertilizer too close to the germinating seed row. A high soil test for P and K would require no fertilization.

Green beans are a legume and do fix some needed nitrogen (N) but the N fixing bacteria are not as active as with other legumes. Inoculation is not practical. Therefore, an N addition is usually helpful. Use about 30 pounds of N per ace, applied early when first trifoliate leaf is visible. Do not apply too much N. Some varieties become too bushy and few flower buds will set. Check with your seedsman. Sandy soils, under high rainfall conditions, may need a second N application at the bud stage.

Varieties

There are two major types: bush or pole beans. Bush are short, erect plants (determinate) that grow 1-2 feet with a uniform pod set. Variety examples are Greencrop (flat pod or generally referred to as Kentucky wonder types) and Strike, a round or oval pod (referred to as bush blue lake types).

Pole beans are trained on poles, fence, or string and grow 7-8 feet in height and bear fruit continuously (indeterminate). An example would be Kentucky blue.

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Variety	Pod Color	Days to Maturity	Disease resistance	Comments
Provider	Med-green	52	cbmv, pm	A consistent producer, home garden
Bronco	Med-green	53	cbmv	Excellent quality
Benchmark	Med-green	59	cbmv	High yield
Festina	Dk-green	54	cbmv	Straight pods, low fiber
Hialeah	Lt-green	53	cbmv	Excellent quality, concentrated set
Strike	MdLt-green	55	cbmv	Mechanical harvest – standard variety
BBLake 274	MdLt-green	60	cbmv	Popular garden variety
Fortex	Dk-green	60	cbmv	Pole bean, excellent flavor
Ky Blue	Med-green	58	cmbv	Pole bean, old time standard

cbmv = common bean mosaic virus, pm = powdery mildew

For bush bean variety evaluation results from the Muscatine Island Research Farm go to: http://www.public.iastate.edu/~taber/Extension/Progress%20Rpts.htm#beans

Planting

When: Green beans are warm season crop and frost sensitive and should not be planted until the temperature at the 2-inch depth is greater than 55 ^{o}F. Optimum temperature for seed emergence is 77 ^{o}F. If the soil is too cool, you will have uneven emergence, resulting in uneven harvest. Also, under cool, wet conditions green beans are very susceptible to root rot infections, such as *Pythium, Rhizoctonia*, and *Fusarium*. The Provider variety is one of the better ones that will germinate under low soil temperatures.

Generally, mid-May is the suitable time in most of Iowa. Sequence plant for once-over mechanical harvest of high yield and quality. The quality may be present for only one or two days. Also, optimum growth of the bean plant and yield occurs between 65 and 85 ^{o}F. There are usually problems with production if the mean temperature is greater than 85 ^{o}F. High temperature interferes with pollination, resulting in blossom drop, crooked or deformed pods due to the lack of ovule development. Pods become fibrous and poorly formed. When daytime temperatures turn cooler new flowers form which set new pods. This is called split set where two different stages of maturity occur on the plant which is undesirable. Therefore, some

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western areas of Iowa may be too hot in late July for satisfactory bean production. However, in western Iowa late July seeding for the fall crop have produced the highest yields and quality.

Seed Rate: This is dependent on seed size and desired plant population. The amount of seed varies from 50 to 90 pounds per acre, more commonly 60 to 80 pounds.

Row width varies from 30 to 38 inches depending on harvesting equipment. The main harvesters are manufactured to handle 30-32 up to 38-inch row widths, depending on the type of machine. In-row plant spacing varies from 6 to 8 plants per foot – generally, 8 or possibly 9 plants on sandy soil when irrigated and 6 plants per foot on heavy silt loam soil without irrigation. Be sure you check the correct seeding rate for the selected variety because over-seeding leads to lodging, pod rot, pod breakage, and harvested trash. There has been some work with high density production, plant populations up to 175,000 plants per acre, but this has not been completely accepted because of a number of cultural problems, such as high disease infestation.

Example of Seed Required:

Row width = 30 inches

Plants per foot of row = 6

Plants per acre at the spacing = approximately 104,000

Seeds per pound: Bronco at 1,700 seeds per pound (read tag for actual number)

Germination = 90%

Pounds of seed required per acre = 68 pounds

i.e. 104,000/1700/0.9 = 67.9 lbs/acre

Note: seed cost is a major component of acreage expense. Most seed is sold by the 1000 (M) rather than pound. Thus, in our example at a seed cost of $2.45 per M our cost per acre would be $254.80 per acre.

The high plant population is based on requirements of top management under conditions of high fertility and irrigation to produce high uniformity and maturity in grade for mechanical harvesting.

Depth: One to 2 inches. Plant deeper on sandy soils and for fall plantings. Use a depth of about one inch on silt loams with irrigation. Drive slowly – about 2 to 3 miles per hour to avoid seed coat cracking with plate planters. Green beans are fragile. Dropping seed bags or rough handling will cause cracking of the seed coat resulting in poor emergence and deformed plants (bald headed).

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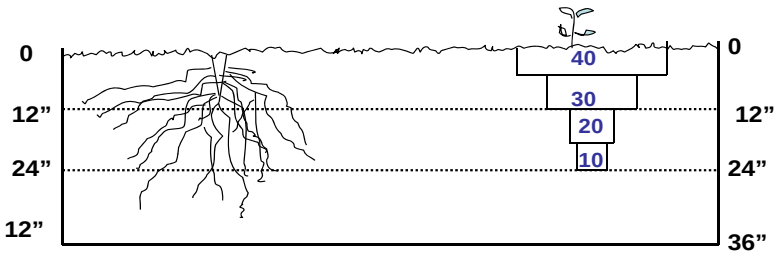
Irrigation

Because green beans are shallow rooted, they will need to have adequate moisture for top production. The most critical time is the blossom and bud development through pod set period. Green beans are particularly susceptible to blossom drop under water stress, causing a split set. Recommended application on loams to silt loam soils would be 1 ¼ inches of water per week unless rainfall supplies that amount. For sandy soils, more frequent application with lesser amounts at each application are necessary. To avoid excessive costs and over watering, use soil water measuring techniques, such as tensiometers or watermarks coupled with a water budget balancing sheet incorporating evapotranspiration (ET) criteria. See the tensiometer tips fact sheet at; http://www.public.iastate.edu/~taber/Extension/Second.htm. Irrigation practices will give more consistent yields from year to year.



Note, from the above diagram:

- **shallow rooted: 70% roots in top 12”**
- **need 1 ½” water per week**
- **critical time = bud development to pod set**
- **Silt loam would have a 10 day capacity (2”/foot, 50% usable, rooting depth 2’, ET = .2/day)**

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Pest Management

For the latest recommendations refer to FG 600, Midwest Guide for Commercial Vegetable Growers mentioned in the introduction on the first page.

Pod damage from bean leaf beetle feeding

Adult bean leaf beetle

Major insect pests are: **bean leaf beetle**, and to a lesser extent corn borer, aphids, spider mites.

Major diseases are: root rots, **white mold** (*Sclerotinia*), gray mold (*Botrytis*) and bacterial blight.

To reduce disease incident consider the following:

- maintain good air drainage, avoid narrow rows
- avoid plant injury
- avoid over fertilization and frequent irrigation
- control weeds (source of inoculum)
- rotate with small grains or corn
- incorporate debris immediately following harvest so soil microorganisms can feed on disease
- apply fungicides as flowering, if needed, to ensure good coverage of blossoms

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There are many good herbicides available for weed management.

Weed Control Options for Green Beans

Product	Ppi	Pre	Post	REI (PHI)
Treflan 4E	Yes	No	No	12 hr
Eptam 7E	Yes	Yes	No	12 hr
Dual II Magnum	Yes	Yes	No	24 hr
Prowl 3.3EC	Yes	Yes	No	24 hr
Command 3ME	No	Yes	No	12 hr (45)
Dacthal 75W	Yes	Yes	No	Dry
Sandea 75WSG	No	Yes	Yes	12 hr (30)
Basagran 4SL	No	No	Yes	48 hr (30)
Poast 1.5E	No	No	Yes	12 hr (15)
Assure II 0.88E	No	No	Yes	12 hr (15)
Raptor	No	No	Yes	4 hr
Reflex	No	No	Yes	24 hr (30)

REI = re-entry interval, (PHI) = pre-harvest interval, i.e. required days between last application and harvest.

Efficacy of selected product

Product	Grass	Broadleafs	Escapes
Treflan 4E	Good	Poor	Good = P,Pu,L
Eptam 7E	Good	Poor	Good = P,Pu
Dual II Magnum	Good	Poor	Good = N,P,Pu
Prowl 3.3EC	Good	Poor	Good = L,P,Pu
Command 3ME	Good	Good	Poor = N,P,J
Dacthal 75W	Good	None	Fair = L,P,Pu
Sandea 75WSG	Poor	Good	Poor = Pu,J
Basagran 4SL	None	Good	Poor = N,P,R

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Poast 1.5E	**Good**	**None**	
Assure II 0.88E,	**Good**	**None**	
Raptor	**Good**	**Good**	**Poor = FP, R**
Reflex	**None**	**None**	**Good = N, R**

FP = fall panicum, J = jimsonweed, L = lambsquarters, N = nightshade, P = pigweed, Pu = purslane, R = ragweed

Harvest

Harvest generally occurs 50 to 60 days from planting and 15 to 18 days following full bloom although temperatures will affect this time period. Sieve size measurements are used to determine when to mechanically harvest. This is highly dependent on variety. For example, some varieties are harvested when 50% of the beans are in sieve size 4. The sieve size is essentially a graduated series of openings of standard dimensions in a screen through which the beans will or will not pass. Sieve sizes are standard throughout the processing industry. The key as to how fast the beans will mature from one sieve size to another is the fiber and seed content. Generally, under most conditions and for most varieties, size 4 represents the optimum combination of a relatively large size, but yet a relatively low seed and fiber content. Some varieties, such as the Bush Blue Lake, can become larger without an increase in seed and fiber content. Thus, Bush Blue Lake 47 is harvested when 20 to 25% of the beans are sieve size 5.

Mechanical harvesting with a one-row, tractor drawn harvester of a determinate, concentrated set green bean variety. Attention to maturity rate, bean sieve size, and equipment parameters as screens and fan speed are very important.

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Sieve size No. 4, ideal for harvest.

Sieve size > No.4, large seed, high fiber

Storage

Beans may be stored at 42 to 45 ^{o}F and at 95% relative humidity for about one week before quality begins to deteriorate. If the temperature is lowered to below 40 ^{o}F, chilling injury will occur in the form of surface pitting and russet blotches on the pods. Also, once brought to room temperature, rapid decay will occur. Further, beans are ethylene-sensitive so do not place them in storage with vegetables or fruit that generate ethylene, i.e. apples, muskmelons, etc.

For fresh market measurements, a bushel is about 28 pounds.

Boxed after water drained thoroughly

Cooler storage for shipping in marked boxes

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Costs per Acre (Kansas State University, Iowa Growers – estimate only)

Variable Costs – Machine Harvest, 250 bushel/acre

Land charge		$275
Fertilizer		80
Seed (104M)		254
Herbicide, insecticide		62
Fuel and oil		55
Repairs		85
Cartons @ 1.25 ea		338
Packaging		160
Labor (quite variable)		525
	TOTAL	**$1834**

Note: no depreciation taken for machinery, buildings
Returns @ $10.00/bu (average wholesale price)

Yields can range from a low of < 30 bu/acre (hot, dry conditions without irrigation) to >300 bu/acre with irrigation. Comparable processing yields might be 6 to 7 tons/acre.

Yield	Gross	Net Income
100 bu	1000	- 834
150 bu	1500	-334
200 bu	2000	166
250 bu	2500	666

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