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Practices for Production of Erect Dry Beans in Michigan

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Dry beans are a major field crop in Michigan with 500,000 to 600,000 acres of beans planted annually. To help improve this crop, the variety development program at Michigan State University has produced a new "architype", a more erect bean than the common varieties now being grown. This "architype" will be referred to as an upright short vine (USV) in this bulletin. Presently, seed of two white and two black varieties is being increased for availability to Michigan farmers. The white varieties are Swan Valley and Neptune; the black varieties are Domino and Black Magic. This bulletin will outline some production practices associated with these USV varieties. Other sources of information cited in this bulletin should also be used.

Yield and Row Spacing

The USV varieties yield more than standard varieties (Table 1). In 12 locations in 1980 and 1981, Swan Valley yielded nearly 4 cwt/acre more than Fleetwood. Fleetwood yielded more than Swan Valley at some locations, but Swan Valley was superior overall. Domino and Black Magic yielded more than Black Turtle in all cases. The range in yields shows the effect of location and year.

The USV varieties yield more in 14- and 21-inch rows than in 28-inch (Table 2). Preliminary data

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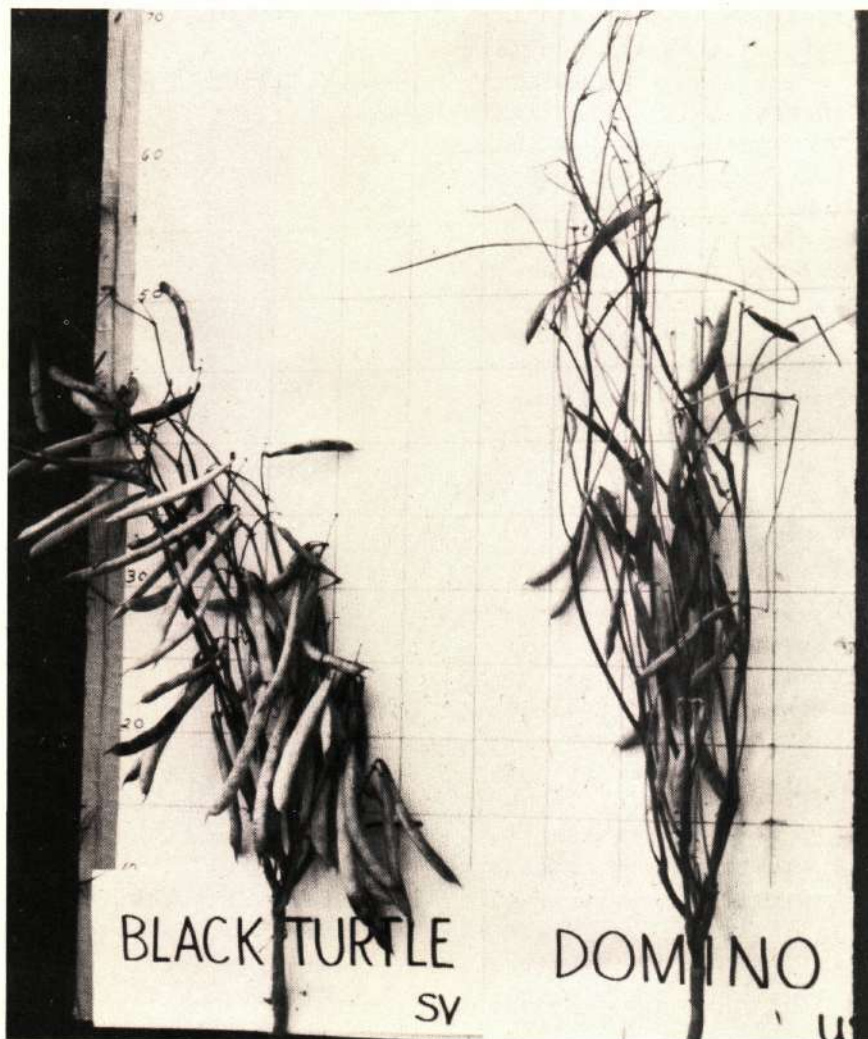


Figure 1. Comparison of a Black Turtle bean plant with an upright short vine (Domino) plant. Note the more erect growth habit and that the pod set is farther from the ground on the Domino variety.

indicate that beans grown in 7-inch rows yield slightly less than those grown in 14- or 21-inch rows. The recommended row spacing is 10- to 21-inches. Beans grown in 7-inch rows may be more susceptible to white mold infection and suffer more from drought than in wider row spacing.

Variety and Seed Selection

Seed of the USV varieties

should be selected with the same care given other varieties. Certified seed is the most reliable source of seed that is free from seed borne diseases. Wherever possible, this quality of seed should be used. Growers who plant uncertified seed should have their seed tested or ask their seed suppliers for results of tests for common bean mosaic virus and bacterial blight. All USV seed

should be treated with streptomycin sulfate, plus an insecticide and a fungicide, similar to present practices.

Planting Management and Seeding Rate

Plant USV varieties after May 20. The period May 25-June 1 is ideal provided moisture and soil temperatures are favorable. Soil temperature should be above 60°F.

Place seeds at a uniform depth in moist soil approximately 1½ inches deep. Planting in dry soil or deep enough to reach moisture is not recommended. If a crust forms at time of emergence, it is advisable to use a rotary hoe or other suitable tool to break the crust. Suggested seeding rates are given in Table 3.

Field Selection and Soil Preparation

Fields that are nearly level and have a loam to clay loam texture are most suitable for production of dry beans. Tile drainage is essential on soils that are somewhat poorly or poorly drained (b and c drainage classes). If the field has low spots where water collects, use a land leveler to improve surface drainage or construct shallow surface ditches to remove excess water. For more details concerning drainage, see Michigan State University Extension Bulletins E-909 "Tile Drainage For Improved Crop Production" and E-1215 "Surface Drainage For Improved Crop Production".

Soil erosion is a major problem on soils in the dry bean producing areas of Michigan, particularly on soils which are fall plowed and left bare all winter. Among the practices which can be used to control soil erosion are cover crops, rye strips, fall planted oats and conservation tillage. The latter is tillage which leaves residues on the soil surface. Michigan State University Extension Bulletins E-525

Table 1. Comparison of yields of USV dry beans with standard varieties.

| Variety ^a | Average | Range | Variety ^b | Average | Range |
|----------------------|-------------|-----------|----------------------|-------------|-----------|
| | ---cwt/A--- | | | ---cwt/A--- | |
| Swan Valley | 23.8 | 11.9-38.8 | Domino | 23.0 | 11.7-38.6 |
| Fleetwood | 19.6 | 16.2-27.2 | Black Magic | 22.3 | 10.9-37.0 |
| | | | Black Turtle | 18.0 | 7.8-33.4 |

^a 12 locations in 1980 and 1981 in 30-inch rows.

^b 13 locations from 1979-1981 in 30-inch rows.

Table 2. Comparison of yields of USV navy and USV black beans grown in different row spacings in 1979 and 1980.

| Class | Row Width | | |
|-------|--------------------|------|------|
| | 14" | 21" | 28" |
| | -----cwt/acre----- | | |
| Navy | 31.0 | 31.9 | 26.4 |
| Black | 27.9 | 31.0 | 25.8 |

Table 3. Suggested planting rates for upright short vine dry bean varieties.

| Row Spacing (in) | Seeds/ft of row | Approximate seeds/acre | Approximate lb/acre |
|------------------|-----------------|------------------------|---------------------|
| 7 | 2 to 3 | 187,000 | 75-80 |
| 10 | 3 | 157,000 | 62-67 |
| 14 | 4 | 149,000 | 60-65 |
| 20 | 5 | 131,000 | 52-57 |
| 30 | 6 | 104,000 | 40-45 |

"Wind Erosion Control On Upland Soils" and E-1169 "Soil Erosion By Water . . . An Unsolved Problem" contain additional information concerning soil erosion control measures.

Recent research with USV varieties has shown that conventional tillage (4-6 passes for secondary tillage, herbicide application and planting) yielded 10-20% less than noncompacted soil (1 pass). Excessively compacted soils (8-10 passes) yielded 20-40% less than the noncompacted soil. While it is generally impossible to eliminate secondary tillage, every effort should be made to reduce the number of trips made over the field. In addition, efforts to reduce the area covered with wheel tracks should reduce the amount of compaction. Where possible, subsequent trips should be made in the same tracks as the preceding pass. Avoid tilling the soil when it is too wet.

Fertilization

The amount of fertilizer needed is best determined by a soil test. Dry beans are sensitive to fertilizer applied in contact with the seed. When drills are used which apply the fertilizer in contact with the seed, apply no more than 150 lb fertilizer as a starter material. This fertilizer should contain any required zinc and manganese. Where possible, apply starter fertilizer two inches to the side and two inches below the seed. Avoid using starter fertilizers which contain boron.

Nitrogen rates for USV dry beans grown in 10- to 21-inch rows where no legume is grown or manure is applied should be 60 to 75 lb N/acre. On 28 or 30-inch rows, 40 to 50 lb N/acre is suggested. Where a legume is plowed down or where livestock manure is applied, apply 20 to 30 lb N/acre on narrow rows and 10 lb N/acre on wide rows. Phos-

phorus and potassium rates are best determined by a soil test.

Zinc and manganese may be needed on mineral soils with a pH above 6.8. Soil test to determine these needs. These nutrients should be included in the starter fertilizer since they are too expensive to apply at broadcast rates. If manganese chelate is used, apply with the starter fertilizer at 8 lb Mn/acre. When chelated zinc is used, apply in the same manner at 0.5-0.8 lb Zn/acre.

In the event that no starter fertilizer is used, watch for zinc and/or manganese deficiencies. If needed, make a foliar application using Table 4 as a guide for rates. Note the percent of element associated with the chelated (EDTA) sources. This is the maximum amount of metal which can be chelated. Materials with greater levels of metal are not fully chelated. No recommendations are made concerning foliar application of such materials.

Weed Control

Weed control programs which have been used on conventional varieties will also be effective on the USV varieties. A combination of chemical and cultural (cultivation) practices is used. However, cultivation is not possible in narrow rows. When USV dry beans are grown in narrow rows, use the cleanest fields. Use a good weed control program on all crops in the rotation. Perennial weed control should receive special attention during the entire rotation.

A preplant incorporated program, a combination of preplant incorporated plus preemergence materials, or a preemergence alone are three weed control options. Preemergence herbicides are sometimes not as effective as desired since rain is required for activation. A post emergence herbicide program should be considered when beans are grown in narrow rows.

For specific recommendations see Michigan State University Extension Bulletin E-434 "Weed Control Guide for Field Crops".

Diseases and Their Control

Several diseases affect dry edible beans. Table 5 shows the disease reaction of available USV and upright bush varieties. Bacterial blight, common bean mosaic virus and anthracnose are seed borne and can be perpetuated by planting disease infected seed. Fusarium root rot is a soil borne pathogen and is not spread by the seed. Table 6 lists several diseases, their method of spread and their control.

Conditions which favor Fusarium root rot and other soil borne diseases include, poor soil aeration resulting from soil com-

paction or poor soil drainage, low soil temperatures and rotations with beans grown frequently. Planting beans every three or four years is best and the return of as much organic matter as possible aids in reducing soil compaction. Avoid working fields when the soils are wet.

Insect Pests and Their Control

Good management that yields a weed free, vigorous stand of beans will minimize insect problems. The first step in insect control is to plant seed treated with an insecticide to control the seed corn maggot. After emergence, fields should be checked regularly, especially during the seedling stage and from flowering through small pod stages. In the seedling stage, seed

Table 4. Rates of zinc and manganese for foliar application.

| Nutrient | Source | Overall* | | 7' band on 28' rows | |
|-----------|-------------------------------|------------|------------|---------------------|------------|
| | | Element | Material | Element | Material |
| | | rate/acre | | rate/acre | |
| Zinc | ZnSO ₄ (36% Zn) | 0.3-0.7 lb | 0.8-1.9 lb | 0.07-.18 lb | 0.2-0.5 lb |
| | ZnEDTA (8-10% Zn) | 0.25 lb | 1 quart | 0.06 lb | ½ pint |
| Manganese | MnSO ₄ (28% Mn) | 1-2 lb | 3.6-7.2 lb | 0.25-0.5 lb | 0.9-1.8 lb |
| | MnEDTA (5-7% Mn) | 0.5 lb | 1 gallon | 0.1-0.25 lb | 1 quart |

* Recommended rate and method for row spacing less than 22 inches.

Table 5. Disease reactions of upright short vine and upright bush varieties of dry beans.

| Class and Variety ^a | Bacterial Blight | | Common Mosaic Virus | | Anthracnose | | | | Rust |
|--------------------------------|--------------------|------|---------------------|-----|-------------|------|-------|-------|------|
| | Common and Fuscous | Halo | V1 | V15 | Alpha | Beta | Gamma | Delta | |
| Navy | | | | | | | | | |
| Swan Valley | S ^b | T | R | R | S | R | R | R | R |
| Neptune | S | T | R | R | S | R | R | R | R |
| C-15 | S | T | R | R | R | S | R | S | S |
| C-20 | S | T | R | R | S | R | R | R | R |
| Black | | | | | | | | | |
| Domino | S | T | R | R | S | S | R | S | R |
| Black Magic | S | T | R | R | S | R | R | R | R |
| Midnight | S | T | R | R | S | R | R | R | R |

^a C-15 is an upright bush, all others are upright short vine

^b S = susceptible, R = resistant, T = tolerant.

corn maggot, cut worms and the first generation of Mexican bean beetle are the insects of concern. From flowering through the small pod stage, watch for second generation Mexican bean beetle, potato leaf hopper, tarnished plant bug, green cloverworm and bean aphids. Further information is available in Michigan State University Extension Bulletins E-499 "Protecting Soybeans and Dry Beans From Insects and Nematodes" and E-1582 "Chemical Control of Insects and Nematodes in Field and Forage Crops."

Harvesting

In the direct combining of the USV dry beans, take care to avoid shattering, cracked beans, checked beans and losses over the sieves of the combine.

If the beans are cultivated, take extra care to not hill the rows. Consider some sort of leveling device behind the cultivator shovels.

Use a floating cutting bar along with a pick-up reel. Adjust the reel as low as possible and slightly forward of the position usually used for small grains. Angle the fingers on the pick-up reel about 20° to the rear of being perpendicular. The forward and lower position of the reel in combination with the angled fingers should provide a lifting action on the standing plants and a movement of vines into the transfer auger behind the cutting bar. Reel speed is critical so the vines are not beaten. Because the fingers on the typical reel are too far apart, additional fingers should be added to space them 2-3 inches apart.

Summary

In summary, the following tips are suggested for successfully

Table 6. Bean diseases and their control.

| Disease | Method of Spreading | Control |
|---------------------------|--|---|
| Halo bacterial blight | Splashing water, insects, animals, seed | Copper sprays, disease free seed, crop rotations, seed treatment |
| Common and fuscous blight | Splashing water, insects, animals, seed | Disease-free seed, crop rotation, seed treatment |
| Common bean mosaic virus | Aphids | Disease-free seed |
| Root rots | Plowing, cultivation, moving soil against plants | Tolerant varieties, crop and tillage management to improve soil conditions. |
| Bean rust | Wind blown spores | Fungicide sprays |
| Bean anthracnose | Infected seed | Disease-free seed, fungicide sprays |
| White mold | Splashing water, wind | Fungicide sprays |

growing USV dry beans:

1. Start with the best quality seed available.
2. Prepare the land uniformly without over-working it.
3. Row spacing of 10-21 inches is suggested. Plant in moist soil at a uniform depth not over 2½ inches deep. A better depth is 1½ inches.
4. Plant early. The best time is May 25-June 1.
5. Try to achieve a full season — full spectrum weed control through total management, including selecting clean fields, proper tillage and herbicides.
6. Use other pesticides and fertilizer as needed and recommended.
7. Harvest directly with a properly equipped and adjusted combine.

Other Literature on Dry Bean Production

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