Reid - 12,000 - 3-12-70
new Hodges

FACT SHEET

L-902

KEYS TO PROFITABLE SOYBEAN PRODUCTION

R. J. Hodges, Robert B. Metzer and Frank C. Petr*

ADAPTATION

Soybeans, an important Texas cash crop, are produced primarily on the irrigated High Plains, eastern portion of the Coast Prairie and the Red River Valley of Northeast Texas. Soybeans are adapted to the same general soil and climatic conditions as corn, cotton or grain sorghum, provided moisture, disease or insects are not limiting factors.

In low rainfall areas, yields have been too low or inconsistent for profitable production under dryland conditions. Requirements for moisture in late summer minimizes economic soybean possibilities in the Blacklands and Rolling Plains. In the Blacklands, cotton root rot seriously hinders soybean production. Limited moisture at critical growth stages occasionally may prevent economical yields even in high rainfall areas of Northeast Texas and the Coast Prairie.

MOISTURE REQUIREMENTS

Twenty to 30 inches of water normally produce good soybean yields. However, availability of moisture during critical growth stages is more important than the total amount. Water requirements are similar to those for cotton, since moisture demands for both are critical during the late growing season. However, irrigations on cotton usually end in late season, thereby forcing maturity, while irrigation on soybeans may continue until seed mature. Yields from all soybean varieties may be limited by insufficient moisture during August and September. Late-maturing varieties may require supplemental moisture through early October. During the seedling stage only, small quantities of moisture are necessary for continuous growth. Higher soil moisture levels should be maintained during flowering and fruiting periods. Under dryland conditions, the distribution and amount of rainfall during flowering and until pods mature will determine the economy of growing soybeans.

SEEDBED PREPARATION

Prepare the seedbed for soybeans as for cotton, corn or grain sorghum. The seedbed should be firm, free of weeds and the row surface should be slightly to well above general ground level to facilitate irrigation and harvest. On heavier soils of the Coast Prairie, planting on beds is essential to prevent stand loss during the early growing period when rainfall generally is excessive. Bed planting is utilized on the irrigated High Plains for efficient irrigation and harvest operations.

PLANTING, RATE AND DEPTH

Soybeans usually are planted in 36- to 40-inch rows; however, from limited research and farmer experience, it appears that row spacing of 10 to 20 inches may increase yields 2 to 5 bushels per acre if moisture is adequate. The wider row system permits utilization of regular cultivating equipment. Enough viable seed should be planted to insure 8 to 12 plants per foot in the drill row for maximum yields that are easier to harvest. Depending on seed size, 40 to 60 pounds per acre will be required for the 36- to 40-inch rows. Rates up to 90 pounds per acre may be necessary where double or narrow rows are used. However, research at Beaumont, Texas, and in Alabama indicates that 60 pounds of viable seed per acre are adequate regardless of row width. Weeds will be more troublesome during the seedling stage when stands are thin. Plant seed 1 to 2 inches deep with a corn or cotton planter equipped with a bean plate. Narrow row spacings can be obtained with a grain drill by plugging certain flutes or by using newer types of unit planters.

SEED QUALITY AND INOCULATION

Soybean seeds should be pure for variety, free from weed seeds and diseases and have a 90 percent germination or higher. Use certified seed or seed of comparable quality. Soybean seeds deteriorate more rapidly with age and improper handling than most legume seeds because of their high oil content. Improperly stored seed more than 1 year old and mechanically damaged seed are unsafe for planting. If a farmer saves his own seed for planting, a germination test should be made before planting so rates may be adjusted if necessary.

Inoculate soybean seed just before planting with a special soybean bacterial culture, even though soybeans were grown previously on the field to be planted.

Mix moistened seed thoroughly with inoculant. Water or a water-sugar mixture helps the inoculant stick to the seed. Each seed must be coated thoroughly. Since sunlight, heat and excessive drying will impair or destroy effectiveness of the bacteria, plant seed immediately after inoculation. When properly inoculated, soybean plants may begin fixing nitrogen 2 weeks after emergence.

*Extension agronomist, Texas A&M University; Extension area agronomist, Lubbock; and Extension area agronomist, Amarillo.

Texas A&M University • Agricultural Extension Service • John E. Hutchison, Director • College Station

SEED TREATMENT

Plant high-germination seed when possible to help control seedling disease. Seed germinating below 85 percent should be treated with a fungicide, such as Arasan, before planting. Seed treatment is especially beneficial for seeds with low vigor. However, seed treatment may decrease inoculation effectiveness.

FERTILIZATION

Fertilize according to soil test. Apply fertilizer to the side and below the seed at planting or below the seed before planting. Do not apply directly with the seed. Nitrogen and potash are particularly harmful to germination. If nodulation is poor, sidedress with 15 to 30 pounds of nitrogen. Pale green plants sometimes indicate nitrogen deficiency caused by poor nodulation.

On fertile land or where preceding crops have been fertilized heavily, fertilizer requirements for soybeans may be reduced or omitted. Experience and research studies indicate that soybeans utilize native and residual fertility. In lieu of a soil test, consider using up to 30 pounds of nitrogen (N), 30 to 60 pounds of phosphorus (P_2O_5) and 30 to 60 pounds of potassium (K_2O). Nitrogen rates should not exceed 30 pounds N per acre. Responses from nitrogen fertilization have not been reported except on acid soils or where inoculation was ineffective. In many areas of the state, soybeans have not responded to fertilizer applications, but highest yields have been produced on soils known to be highly fertile.

LIMING

Lime application can increase availability of other plant nutrients in acid soils. Lime also increases growth of beneficial soil bacteria and other micro-organisms which aid in decomposition of organic materials. Nitrogen-fixing bacteria work best around a pH of 6.5. Liming acid soils tends to make native molybdenum more available to plants.

Broadcast and mix lime thoroughly with the soil before planting. If soil pH is below 5.5, apply lime early enough to allow time for it to react before planting. Determine amount of lime needed and application frequency by soil pH test every 2 or 3 years.

RECOMMENDED VARIETIES BY PRODUCTION AREAS

SOUTH PLAINS:

Plainview area and north

Hill, Wayne, Patterson and Clark 63

Plainview area and south

Hill, Lee and possibly Hood

NORTH PLAINS:

Wayne, Clark 63 and Patterson

GULF COAST AREA:

Lee, Bragg, Hood, Semmes, Davis, Bossier and Hampton 266

NORTHEAST TEXAS RED RIVER VALLEY:

Lee, Bragg, Hampton 266, Dare and Davis

IRRIGATION

Irrigation requirements vary with soil type and geographical location. In irrigated areas, unless good subsoil moisture is available, apply preplanting irrigation to wet the soil root zone. For maximum yields, irrigate just before bloom initiation and at 10- to 20-day intervals until pods are well filled. At Lubbock, over a 5-year period, a preplant plus five summer irrigations produced maximum yields. However, in the same area, the most efficient use of total water, rainfall and irrigation, was obtained by preplant plus two summer applications (bloom stage and one additional irrigation 20 days later). Additional irrigation may be necessary if soil begins drying before seed pods are filled. Also, a prebloom irrigation may be beneficial in promoting vegetative growth of early-maturing varieties which aid in higher pod set. Research conducted in the northern High Plains indicates further that yields are closely associated with moisture levels during the bloom and pod set stage. It showed that soybeans are capable of profitable yields from high moisture levels during this growth period.

WEED CONTROL

Mechanical weed control is an effective method of controlling weeds in soybeans. Because soybeans are fast-growing plants that rapidly shade the soil (in 3 to 5 weeks), early season weed control is most important. The rotary hoe is an efficient tool for early season weed control. Rotary hoe cultivation should begin just before weed emergence and continue until soybeans are 4 to 6 inches tall, or until it would cause excessive injury to the soybeans. Injury can be reduced by working during mid-day when soybeans are slightly wilted. The rotary hoe usually is more effective after light rains, when a light crust has formed on the soil surface. One to two cultivations with sweeps usually are required to complete weed control.

Ridging rows more than is necessary to control weeds is not helpful. Ridging does not make plants stand better, and pods are produced about the same distance up the stem from planting depth on ridged and unridged rows. Cutterbar losses often are increased on ridged rows from cutting above or through pods at harvest.

Herbicides now available can give full-season control of grasses and most broad-leaved weeds. They can be used before or just after planting. After soybean plants have emerged, other chemicals can be used to control weeds not controlled by preemergence treatments.

Chemicals are a supplement to good cultural practices, not a substitute. Check with your local county Extension agent or refer to B-1029, *Suggestions — Weed Control with Chemicals.*

INSECTS

Insects may be grouped according to type of damage they inflict upon the soybean plant: (1) stem and root feeders or stalk feeders, (2) foliage feeders and (3) pod feeders. The three-cornered alfalfa hopper may be the most important stalk insect. Those attacking leaves include leaf beetles, blister beetles, velvetbean caterpillar, fall armyworm, green cloverworm and various loopers. Important pod insects are stinkbugs and the corn earworm (cotton bollworm). Stinkbugs have caused economic losses to Gulf Coast soybean farmers for several years. They pierce the immature seeds with their needle-like mouthparts and withdraw plant juices, which may prevent normal development of the seeds and cause lower yields. On older, more mature seed, the puncture provides an entrance for secondary microscopic organisms which cause spotting and discoloration, resulting in quality loss and downgrading. Corn earworms consume the pod and seed, resulting in yield loss.

DETERMINING ECONOMIC INSECT INFESTATIONS

From emergence through blooming, the soybean plant can withstand 40 percent defoliation without important yield losses. However, when pods are forming and beginning to fill, a 20 percent foliage loss will decrease yield. Leaf function is most important during pod formation and filling. After pods are fully filled and seeds are nearing maturity, up to 35 per cent defoliation will not cause economic yield reduction.

To determine infestations by other insects, check 3 feet of row in ten spots per field weekly. Scatter these 3-foot checks over the field to assure an adequate sample. At each check, shake plants from 3 feet of row over a 2′ x 3′ white cloth placed between the rows. Count the number of corn earworms and stinkbugs dislodged from the plants. Thirty corn earworms per 30 feet of row or 10 stinkbugs per 30 feet of row constitute an economic infestation.

Contact your local county Extension agent for the latest information on soybean insect control.

DISEASES

About 50 diseases are known to affect soybeans, and annual losses are estimated at 12 percent of the total crop. Usually at least one disease is present in any field. Intensity of disease development and resulting crop loss depend on organisms present and occurrence of weather conditions that favor disease development. Because most soybean diseases are soil-borne, consider rotating with unrelated crops that are not susceptible to the same diseases.

For further information, see MP-916, *Soybean Production in Texas,* available from your local county Extension agent.

HARVESTING

Seed on a soybean plant mature at essentially the same time. Seed maturity is accompanied by rapid dropping of leaves and drying of stems. The final maturing process is so rapid that chemicals applied early enough to hasten leaf-dropping result in reduced yields. Benefits from applying dessicants for drying weeds in soybeans may not compensate for the expense of application. If chemicals are applied before soybean leaves begin to turn yellow, yields will be reduced. Chemicals applied must have federal clearance before application if soybeans are to be used for food or feed.

Combining should begin when the moisture content is below 14 percent to minimize losses caused by shattering, cutterbar action, threshing, separating and cleaning. The combine operator should check reel speed and height, ground travel speed, cutterbar height and sharpness, pick-up action of lodged plants by guards or special attachments. Also attention should be given to cylinder speed and concave clearance and flow of material over the rack as indicated in the operator's manual. Position the reel to cause minimum disturbance of standing plants. Moisture variance during the day necessitates combine adjustments to correct for changing conditions.

A loss of four seed per square foot is equal to about 1 bushel per acre. Usually 80 percent of the total harvest loss results from failure to get all pods into the machine. About 50 percent is shatter loss. Excessive or inadequate reel speed is one cause of shattering. Reel speed should be run just deep enough in the beans to control the stalks, and should be about 6 to 12 inches ahead of the cutterbar.

Operate the cutterbar as low as possible. Shattering, dropped stalks and pods left on the stalk below the cutterbar account for most of the loss.

Ground speed should be 2½ to 3 miles per hour. Most combines have a fixed sickle speed. As ground speed increases beyond 3 miles per hour, the cutterbar begins stripping the pods before the stalk is cut, causing seed loss. Uneven stubble height indicates excessive forward speed. As forward speed increases, it is difficult for most operators to keep the header down on the ground, resulting in more pods remaining on the stalk.

Mechanical damage is another source of loss to the soybean grower. Broken beans and splits can reduce the market grade. Mechanical injury is one of the principal causes of low seed quality. Injuries result primarily from impact of the seed with hard surfaces.

MARKETING

U. S. soybeans enjoy a growing domestic and world market. For marketing procedures that will result in the biggest net price, the following recommendations are made to producers:

1. Since marketing can greatly influence "net farm business income," know as much about your marketing alternatives as you do about production alternatives.
2. Link your production program with your marketing program as inter-related phases of your business.
3. Develop a system of acquiring, analyzing and understanding marketing costs.
4. Consider the large seasonal price changes and the alternative of storing to selling at harvest time.
5. Develop effective bargaining and marketing programs through group effort.
6. Contract your soybeans before planting if terms of such arrangements are satisfactory.
7. Utilize the futures market when appropriate.
8. Utilize government loan arrangements when advantageous.
9. Watch the timing of your marketing.

Export sales of soybeans have been increasing and more than 40 percent of U. S. production is moving into expanding world markets as whole grain, oil or meal. The demand for soybean meal, both in domestic and foreign markets, is stronger than for oil. In the immediate future, the bulk of soybean and soybean meal exports will go to developed countries commercially, and nearly all soybean oil exports will go to the developing countries under food aid assistance. Export sales will be affected by tariff and non-tariff restrictions, especially by the European Economic Community, and the exports from other vegetable oil producing countries, especially Russia.

Estimated yield, price, income, production costs, harvesting costs and income over specified costs per acre for dryland and irrigated soybeans

	Dryland	Irrigated
Yield — bu. per A.	25	35
Price — $ per bu.	$ 2.25	$ 2.25
Income — $ per A.	$56.25	$78.75
Production costs per acre		
Seed	$ 4.25	$ 4.25
Inoculant	.50	.50
Fertilizer[1]	10.80	7.80
Herbicide	6.00	6.00
Insecticide and application	3.00	3.00
Irrigation		13.20
Machinery	4.90	6.48
Labor	4.40	9.55
Interest on operating capital	1.35	2.03
Total specified production costs	$35.20	$52.81
Harvesting costs per acre		
Combining — custom	$ 3.00	$ 4.20
Hauling — custom	1.50	2.10
Total specified harvesting costs	$ 4.50	$ 6.30
Total specified production and harvesting costs	$39.70	$59.11
Income over specified costs[2]	$16.55	$19.64

ECONOMICS OF PRODUCTION

Increased production efficiency may be achieved by adopting practices proven profitable through research and result demonstrations. Make decisions to adopt improved production practices based on added costs versus added returns. Consider first production practices which most affect cost or income. Soil fertility, moisture management, insect control, weed control, disease control, variety selection and harvesting influence the profitability of soybeans.

Adequate records and accounts are necessary for measuring progress and making changes in production practices.

Cultural practices, usual date, times over, hours per acre, cost per hour, and cost per acre for dryland and irrigated soybeans

Cultural practice	Usual date	Times over	Hours per acre		Cost per hour		Cost per acre	
			Labor	Machinery	Labor	Machinery	Labor	Machinery
Disk	Sept.-Nov.	1	.28	.25	$1.50	$1.72	$ .42	$ .43
Flatbreak	Dec.	1	.83	.75	1.50	2.00	1.25	1.50
Disk	Jan.	1	.28	.25	1.50	1.72	.42	.43
Float[3]	Jan.	2	.37	.34	1.50	1.71	.56	.58
Bed and fertilize	Feb.	1	.28	.25	1.50	1.92	.42	.48
Preirrigate[3]	April	1	.60		1.50		.90	
Cultivate bed	May-June	1	.22	.20	1.50	1.76	.33	.35
Plant and apply herbicide	May-June	1	.37	.33	1.50	1.96	.56	.65
Rotary hoe	May-June	1	.11	.10	1.50	1.76	.17	.18
Cultivate	June-Aug.	2	.55	.50	1.50	1.76	.83	.88
Run water furrow[3]	July-Sept.	3	.66	.60	1.50	1.66	.99	1.00
Irrigate[3]	July-Sept.	3	1.80		1.50		2.70	
Insecticide application	June-Sept.	2	Custom					
Harvest-haul	Sept.-Nov.		Custom					
Total dryland			2.92	2.63			$4.40	$4.90
Total irrigated			6.35	3.57			$9.55	$6.48

[1]Research and demonstration work by public and private concerns has shown to date little or no significant yield increases from direct application of fertilizers in the High Plains area.
[2]Costs do not include unallocated costs such as interest, taxes and insurance on farm real estate and machinery, depreciation on farm machinery and pickup expense.
[3]Practices do not apply to dryland budget.

Cooperative Extension Work in Agriculture and Home Economics, Texas A&M University and the United States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
12M—2-70 AGR 6