VALLEY

Growing
Irrigated Soybeans

Introduction

Soybean, also known as soy or soya, is the world's leading oilseed crop, used for edible and industrial oils and both human food and animal feedstuffs. The plant is a native of Asia, and has been produced there for thousands of years. Since 1942, however, the United States has been the world's leading soybean producer.

In recent years, Brazil has dramatically increased production and exports, and these two countries are now approximately equal in annual production of soybean, each with about one-third of the world's total production. Argentina is third, producing less than half of the other two countries. Ironically, China, the source of the plant, currently produces only about 4% of world supplies, for fourth place.

This guide discusses some of the considerations in growing irrigated soybeans.

Seed and plant selection

Selecting appropriate genetic material is a key part of successful soybean production. Since it is self-pollinating, soybean is a difficult crop to hybridize. This has led to the development of hundreds of commercial varieties, each adapted to specific local conditions. Varieties have been developed to prosper for growing season lengths ranging from very short (as found in areas at 45° or greater latitudes) to much longer (tropical areas).

There are two types of growth habit: determinate and indeterminate. Indeterminate varieties continue to add vegetative growth after flowering, while soybeans with determinate growth habit complete most vegetative growth before flowering. Historically, indeterminate varieties have been more popular in the United States corn belt, while determinate varieties are grown in the southern U.S. and in South America.

Soybean varieties in the U.S. are rated by maturity group, with geographic areas defined to represent season length. Maturity groups range from 00 (near the Canadian border) to IX (in southern Florida). Many varieties are also identified to growing sub-areas within the group numbers.

In addition to growth habit, maturity group and yield potential, other traits are often important considerations for growers, such as disease resistance, resistance to shattering or lodging, and adaptation to wide or narrow row distance. There are also varying types and degrees of resistance to insects, such as Soybean Cyst Nematode (SCN). Other traits that may be important for marketing purposes include color of the seed coat or hilum, oil and/or protein content, and other traits that may be critical for specific processing and end use of the crop.

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In the past 25 years, genetically modified, herbicide-resistant soybeans have become quite popular, especially in the U.S. These varieties have allowed farmers to lower weed pressure and improve yields and profitability. Problems with herbicide resistance in local weed populations have increased, so wise management of these traits is especially critical in order to maintain efficacy of the products available.

Traditionally, in order to minimize input costs, it was a common practice to save a portion of the harvested soybeans to plant the following season. Before the advent of GM soybean traits, the self-pollinating nature of the crop made this a viable option. Licensing issues with these new traits have made this less common. If growers choose to pursue this practice, seed germination tests should be used prior to planting, to ensure adequate emergence and plant populations. While first-year seed will likely have good germination (80% or greater), germination rate may decline to 65% after the second year of storage.

Planting

Good germination and early vigor are important for healthy crop establishment. Soybeans should be planted in warm, moist soil, with a forecast of warm weather to enhance emergence. Soil temperature should be at least 16° C (60° F) at planting depth. Optimum planting depth varies with location. The USDA and local Agricultural Extension offices often publish planting recommendations. This includes such characteristics as appropriate maturity group, planting date and depth, and optimum seed populations.

For example, across much of the corn belt, farmers traditionally focused on early planting of corn, and turned their attention to soybeans after the corn crop was complete. However, research conducted during the past 30 years in southeast Nebraska has found that early planting of soybeans is beneficial, with yield reductions averaging up to one bushel/acre per day of delayed planting past April 30.

Planting depth will depend on local climate and soil conditions, and commonly ranges from 4-6 cm (1.5-2.5 inches). Research has shown that deeper planting helps the plant establish a more extensive root system, and increases yield. Seeds should be planted into a moist, firm seedbed; dry planting conditions and post-plant irrigation can lead to soil crusting and decreased emergence. If soil conditions are dry, it is better to pre-irrigate, then plant.

Soybeans have a great capacity to compensate for population losses, both during the growing season (e.g., losses due to hail) and as a result of low planting population. As a result, recommended planting populations have decreased in recent years. Research at land-grant universities has shown that decreasing seeding rates can increase profitability (due to reduced seed cost) while maintaining yield.

Seeding as few as 295,000 seeds/ha (120,000 seeds/acre) can, in some cases, result in yields equivalent to those up to 50% higher. Local conditions will dictate actual limits, and growers can do their own on-farm research to find what rates work best for them. Many growers have also switched to narrowly spaced rows (from 75 cm, or 30 inches, to 20 cm, or 8 inches) in order to speed soil shading and improve yield.

Fertility

Local soil conditions will determine crop fertility needs, but we always recommend following Best Management Practices (BMP) to optimize yield, maximize profit and sustain long-term productivity. One of these practices is regular soil testing. Due to crop withdrawal and annual weather variations, it is wise to perform soil tests at least every 2-3 years, and base fertilizer applications on the results. Many nutrients' availability is limited at certain pH levels, so appropriate liming practices should also be considered, based on soil tests.

Soybeans do not usually exhibit a profitable response to nitrogen (N) fertilization. Being a legume, the plant forms a symbiotic relationship with soil bacteria (Rhizobium); the bacteria have the ability to fix N (convert it from organic to the plant-usable inorganic form). This process benefits both plant and bacteria, wherein the bacteria infect plant root tissues. The bacteria get a place to live, and the resulting root nodules provide a source of N to the plant. In soils where soybeans have never grown, seed should be inoculated with appropriate Rhizobium species to help develop such a population.

Furthermore, based on Kansas State University research, an application of nitrogen (20 to 40lbs/acre) at the R3 growth stage can lead to a yield increase of five to ten bushels.

Phosphorous (P) is the second of the three primary macronutrients in crop production. It is relatively immobile, so when soil test values indicate need for P fertilization it is often banded close to the seed row. Banding is a more efficient method of application than broadcasting, since it requires a smaller gross application. In addition, it gives the seedling access to the needed nutrient without the salt-effect damage that would come from putting it in contact with the seed.

The third macronutrient, potassium (K), is important, especially since soybeans are relatively high in K content, so the harvested crop removes a significant amount from the field. Potassium is more soluble than P, and it can be applied with P as a band; it can also be broadcast and incorporated into the soil. Yield increases from K application may be comparable to those from P application, if it is deficient.

Other significant nutrients commonly found to have an effect include sulfur (S) and iron (Fe). S is mobile in the soil, but fairly immobile in the plant. Deficiencies of S are becoming more common in all crops, largely due to the reduction of S in vehicle exhaust and other fossil fuel sources. Iron chlorosis can be an important limitation in some areas of the western Great Plains. Some soybean varieties are more tolerant to iron chlorosis than others, and should be used in areas where this is a historic issue.

Pest Management

Weeds, insects and diseases are issues common to all ag producers. The pressure on an individual field will depend on soil and climate, as well as on specific history. Regular scouting is important to effectively manage crops and deal with issues as they arise. A well-planned Integrated Pest Management (IPM) program is an important tool to maintain good crop productivity. Frequent scouting whether in field, aerially or using field sensors, will help define pest pressure and economic thresholds for treatment.

Whether the pest in question is weed, insect or disease, knowledge of Economic Injury Level (EIL, or the lowest pest incidence that will cause economic damage) and Economic Threshold (ET, the pre-determined number that justifies treatment) are critical pieces of information in forming an appropriate treatment plan.

Appropriate use of herbicides is very important. Weeds compete with crops, including soybean, for water, light, nutrients and carbon dioxide. Historically, two main methods have been used to remove or limit weed competition: mechanical and chemical. Mechanical methods include tillage practices (plowing, disking, cultivating) and specific removal (rogueing, chopping, pulling). Soil shading (via crop growth or mulching) can also be effective.

Chemical methods have become more important in the last century. They tend to be less labor-intensive, require less fuel/horsepower and can often be more effective in limiting and killing weed plants. The rise of herbicides has coincided with the desire to minimize soil disturbance, in order to minimize soil erosion and its concurrent environmental effects.

However, inappropriate herbicide use can also accelerate resistance development in weed populations. As a result, careful management is needed to control resistance development and maintain the efficacy of available herbicide chemistries.

Since pest management is an ongoing battle between biology (weeds, insects and diseases) and available chemistry (safe, effective pesticides and cultural practices), these principles also apply to insect and disease management, which face similar issues with proper use of insecticides and fungicides.

Irrigation

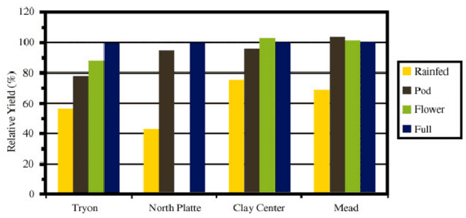
Soybeans, like other crops, can benefit from appropriate irrigation, especially in areas with occasional dry spells during critical growth periods and in sandy soils. Water availability, through rainfall and irrigation, is the single greatest management factor in crop yield. Irrigation scheduling allows producers to match water applied to that needed by the crop.

A "Checkbook Scheduling" method allows the grower to balance water used by the crop with water available from rainfall and irrigation. In this method, water stored in the soil (which is available for use by the crop) is treated similarly to a bank balance of money. Daily or weekly use of water by the crop is treated as a withdrawal from the account, and rainfall and irrigation events are treated as deposits.

Various tools are available to estimate crop water use: a common calculation uses weather data to estimate total evaporation (ETR), and a "crop coefficient," based on the particular growth stage and condition of the crop (KC), is used to adjust this value to represent the actual amount of water used by the crop in this field using the equation: ETR * KC = ETA (actual ET).

In addition to ET calculations, many producers use soil water sensors to keep track of the water available to the crop. This also provides a "check" on crop water use and status, which can improve the accuracy of calculations. It also helps account for unknown factors, such as undefined or unknown rainfall events, and soil drainage.

Soybeans use the greatest amounts of water in late vegetative stages, as well as during reproductive growth. Research has indicated that the greatest yield response to irrigation comes during mid-to-late reproductive stages, known as pod development (R3 – R4) and seed fill (R5 – R6). Irrigation earlier in the season is only recommended to keep the crop going during drought. Irrigation during seed fill is especially important when adequate water was available during flowering, since greater flowering increases seed number, and failure to support this seed load during fill can cause significant yield loss.



Additionally, remote management technology such as Valley Scheduling™ has been developed that integrates data from soil moisture sensors, weather data and more, and formulates irrigation recommendations growers can simply choose to implement. See more the next page.

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Harvest

Harvest management is important, since intermittent rains can cause mature pods to split and drop seeds on the ground, lost to the combine. Soybeans are fully mature when 95% of the pods are at mature color (tan). If stems are still tough or green, adjust the combine and slow speed through the field. Ambient conditions can increase (heavy dew) or decrease (windy, low-humidity day) crop water content. Avoid either extreme of conditions to minimize shattering losses. In general, slowing down and checking/adjusting combine settings several times per day can minimize losses, maximizing crop in the bin.

What Center Pivots Offer Soybean Growers

- **Drought protection** – Pivot irrigation offers insurance against nature's uncertainty.
- **Perfect timing** – Irrigate at key times, such as pod development and seed fill.
- **Precision application** – of crop protection products and crop nutrients.
- **Water and energy savings** – Pivots and linears offer uniformity of water distribution, and up to 97% application efficiency, compared to 50% for flood.
- **Bigger and better** – quality yields with precision application.
- **Sustainability** – Promotes sustainable crop production for both the grower and the environment.

How Valley solutions help overcome challenges specific to soybeans

DIFFERENT AREAS OF A FIELD HAVE DIFFERENT SOIL TYPES, RESULTING IN DIFFERENT MOISTURE LEVELS.

Valley solution: Integrate soil moisture monitors with Valley Scheduling to know exactly how much to irrigate and when. Valley Scheduling results in a 10% average reduction in irrigation water and electrical use. Valley VRI (variable rate irrigation) enables you to irrigate precisely based on field-specific prescriptions, for uniform quality and optimized yield.

WATER RESTRICTIONS ARE BECOMING COMMON, WHILE MONITORING USAGE AND KEEPING ACCURATE RECORDS IS REQUIRED IN MANY AREAS.

VALLEY SOLUTION: Pivots and linears offer uniformity of water distribution, and up to 97% application efficiency, compared to 50% for flood. Flowmeters from Valley offer maximum durability and minimum maintenance. They can help growers be more efficient and monitor their application precisely, saving water, energy, money and effort.

LABOR COSTS ARE INCREASING

VALLEY SOLUTION: With Valley remote management of irrigation machines, one person can easily control multiple pivots or linears with just a smartphone, allowing growers to devote labor resources where and when they are most needed.

MANAGEMENT OF CROP NUTRIENTS AND PESTS

VALLEY SOLUTION: Use the center pivot to apply fungicides and other products to support crop growth.

What Valley Irrigation Offers

Valley is the founder of the entire pivot irrigation industry. We have helped generations of growers overcome watering challenges with the most durable machines and most reliable technology available.

- **The most durable drive train** – Built to handle the toughest conditions and most difficult terrain efficiently, for lower maintenance costs
- **The industry's longest and strongest spans** give you higher return on investment for your operation
- **Valley pivots can last 35+ years** with proper maintenance, and retain their value better than any other brand
- **Customizable options** – Valley machines are adaptable enough to meet the needs of any grower, area, field size, climate, and soil type. The final product is delivered according to your exact specifications, and the team members involved in your project are factory trained, ensuring Valley quality.
- **Innovative technology** – Valley 365® combines the best features of our tried-and-true technology into a single sign-on platform. It's highly secure, fully connected crop management, so you can save time, water, energy and labor.
- **Sustainability** – Valley founded the center pivot industry, bringing water efficiency forward. Now we continue to lead the way in sustainable solutions, including solar power for agribusiness.
- **Superior Service** – The Valley Dealer network is the largest and most responsive in the irrigation industry. Your Valley Dealer is your trusted partner, providing the expertise you need to produce more while using fewer resources.

Conclusion

Growing soybeans is, like other crops, a technical, demanding process. Success requires diligence, attention to detail and correct application of many agronomic principles. This guide is not intended to be a comprehensive text, but rather a brief introduction to several of the areas to consider. Many land-grant universities in the United States, as well as various industry groups, have resources available for further research.

The Leader in Precision Irrigation.

valleyirrigation.com

See your local authorized Valley dealer for complete details.

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