INCREASING SOYBEAN YIELDS
THROUGH EFFICIENT IRRIGATION SOLUTIONS

HIGHER YIELDS... OPTIMUM WATER USE...
LOWER COSTS... PRECISION APPLICATION

LINDSAY™

Why irrigate?

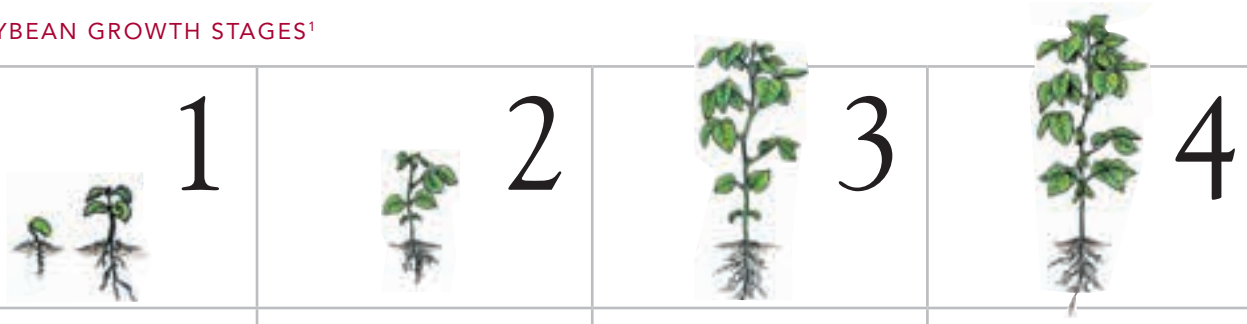
The correct amount of water on your soybean crop is essential for producing high yields. Zimmatic® by Lindsay irrigation systems bring a cost-effective solution, alleviating risk when the weather isn't cooperating. It also gives you more flexibility when it comes to planting, because your timeline is not as affected by nature.

Proper irrigation management minimizes yield loss due to crop water stress, optimizes yield per unit of water applied and promotes good management practices.

The result is a greater return on investment.

Soybean is one of the world's most important crops and is grown for oil and protein. Present global production is about 176 million tons over 185 million acres (75 million ha).[2]

SOYBEAN GROWTH STAGES[1]



1	2	3	4
Emergence: Adequate moisture at seeding encourages germination and root development for healthy, uniform stands.	***Vegetative Growth:*** Excess irrigation during early growth can stimulate vegetative growth that does not lead to yield increases and may increase the likelihood that the crop may lodge.	***Flowering:*** Water that is applied during flowering must be followed by adequate water during seed fill.	***Pod Development/Seed Fill:*** Water stress during these stages of development can significantly reduce yields.

SOYBEAN CROP COEFFICIENTS & PLANT GROWTH STAGES OF SOYBEAN[1]

Crop Stage	Kc	Description
V0 Cotyledon	0.1	Cotyledons extended
V1 1st Node	0.2	Unifoliolate leaves expanded
V2 2nd Node	0.4	Trifoliolate leaves expanded
V3 3rd Node	0.6	Trifoliolate leaves expanded
R1 Beginning Flower	0.9	At least one open flower is present at any main stem node. The first flower generally occurs on node six in indeterminate varieties, but nearly all nodes flower simultaneously in determinate varieties.
R2 Full Flower	1.0	At least one open flower is present at any one of the two uppermost main stem nodes that have fully developed leaves. A node with a fully developed leaf will be just below a node whose leaflets have unrolled to the extent that the leaflet edges are no longer touching.
R3 Beginning Pod Elongation	1.1	At least one pod of 3/16-inch length is present at any one of the four uppermost main stem nodes that have a fully developed leaf. It is not uncommon to see pods of greater length at the lower nodes, plus withering flowers, open flowers, and flower buds on a plant at the R3 stage.
R4 End of Pod Elongation	1.1	At least one pod of 3/4-inch length is present at one of the four uppermost nodes that have fully developed leaves.
R5 Beginning Seed Enlargement	1.1	At least one pod containing small seeds is present at one of the four uppermost nodes that have fully developed leaves. You can hold a pod up to the bright sky to see the small developing seeds in the pod cavities.
R6 End of Seed Enlargement	1.1	At least one pod with cavities completely filled with green seeds is present at one of the four uppermost nodes that have fully developed leaves. The pod, when backlighted by a bright sky, will have its cavities completely occupied by dark green seeds. Seed growth slows after R6, but does not entirely cease until the seed attains physiological maturity.
R7 Beginning Maturity	0.9	At least one (normal) pod that has attained its final mature color (tan or brown, depending on variety) is present on any main stem node.
R8 Full Maturity	0.2	Ninety-five percent of the pods have reached their mature pod color.
Harvest Mature	0.1	

Note: A better Uniformity Coefficient alone does not ensure more yield if the overall crop water requirement is not met and results in a water deficit.
[1]Source: Irrigating Soybean. William Kranz et al. 2005. NebGuide G1367. Stated Kc values are an average. Local Kc values will vary with local microclimate, terrain and soybean variety. Growth Stage Charts (2007) University of Nebraska-Lincoln, Extension Water Issues Team. Retrieved from http://elkhorn.unl.edu/ETGage/jsp/soybeanChart.jsp

Monitoring Evapotranspiration

To effectively plan irrigation, growers need to account for evapotranspiration (ET). Evapotranspiration is the total water use of a crop, including evaporation from the soil and transpiration by the plant. Temperature, humidity, solar radiation, wind, as well as crop health and growth stage affect evapotranspiration.

To determine when to irrigate, the following information is needed:

1. A local weather station report that estimates reference ET. The reference ET must then be multipled by the crop coefficient to determine the water use of the crop each day.
2. A rain gauge placed in each field or group of adjacent fields.
3. An estimate of how much water can be used from the soil before irrigation is needed. (This can be calculated by extension agents or crop consultants).

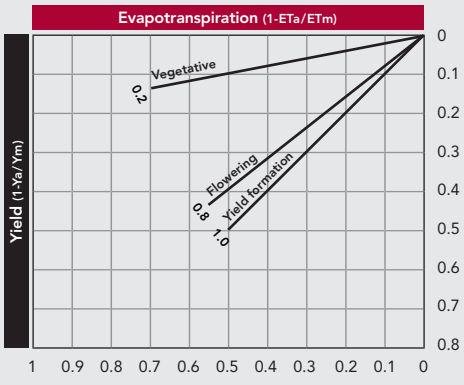
To maintain the starting soil water balance, just subtract the crop water use from each day, add in any rain, and apply enough irrigation to balance the equation to the starting point. Over the irrigation season, the balance can be allowed to become negative by the amount of the allowable water depletion for the soil.

Irrigation Optimization

Soybean plant development can be divided into the vegetative and reproductive periods. The dividing line between the two stages is when the plant has at least one open flower on any main stem node. Irrigation management during the vegetative stages is fairly simple, give the crop just enough water to keep it growing well, but keep in mind that fully watering can stimulate excess vegetative growth without leading to yield increases. In fact, it can lower yields if the taller plants lodge. In many growing regions with medium or fine-textured soils, rain can provide enough water up through the end of the vegetative stage and possibly through the end of full flowering (R2).

Irrigation scheduling during the reproductive stage takes a little more management. Anytime after the start of flowering it is important the keep the crop reasonably well watered. However, the most critical period to provide adequate water for the soybean crop is during the pod development (R3-R4) and the seed fill (R5-R6) because this is the time water stress will cause the most yield loss. When the combination of low soil water and low rainfall make it necessary to start irrigating during the flowering stage, it is usually best to continue to provide good soil water conditions for the crop for the rest of the season. The goal should be to keep the crop fully watered starting at the R3 stage through the end of R6. Research has shown that irrigating after the start of R7 will usually not increase yields.

EVAPOTRANSPIRATION DEFICIT IMPACT ON SOYBEAN YIELD[2]



References

[2] http://www.fao.org/nr/water/cropinfo_soybean.html

Conditions vary by location. Talk to your local Lindsay dealer for more detailed information.

Zimmatic center pivot

CHEMIGATION

Chemigation can provide a quick response to unexpected events like insect infestations, disease outbreaks, and weed escapes. Many crop protection chemicals including insecticides, fungicides, and herbicides, are labeled for application by chemigation.

Advantages of chemigation include:

- Timing – chemicals can be applied at the first sign of trouble
- Uniformity of application – excellent water distribution provides uniform distribution of chemicals and more consistent control of pests
- Incorporation/activation – Chemicals are incorporated and activated by the water they are applied with
- Reduced compaction/crop damage – a center pivot covers a crop without additional areas of compaction or crop damage
- Reduced spray costs – applying chemicals through an existing center pivot is less expensive than using a spray service or dedicated spray equipment
- Reduced hazards – center pivots reduce worker exposure to chemicals

EFFICIENT APPLICATION FOR HIGHER YIELDS

Zimmatic Center Pivot Irrigation – Custom-fit your irrigation system to your fields for uniform application.

Zimmatic Lateral Irrigation – Irrigate 98% of square or rectangular fields, and tow your irrigation system between fields.

References

[1] Freddie Lamm, Daniel O'Brien, Danny Rodgers, Troy Dumler "Sensitivity of Center Pivot Sprinkler and SDI Economic Comparisons" American Society of Agricultural Engineers (ASAE).

[2] USDA National Agricultural Statistics Service.

Why pivots/laterals?

Pivot/lateral irrigation systems – right amount of water at the right time, in the right place

Applying the correct amount of water at the right time is crucial to getting a good yield, but it's also important to apply it uniformly.

Pivots/laterals v. flood irrigation

Less waste

The most obvious benefit to irrigating with a pivot or lateral system is that it produces less waste. You get even, precise water application across the field (Figure A), rather than having too much water at the upper end, and not enough water at the lower end of the field (Figure B). You can also control the timing and amount of water that is applied while eliminating runoff, helping to prevent contamination of the water table and nearby streams.

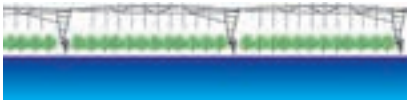


Figure A
Pivot/lateral irrigation

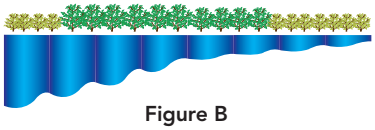


Figure B
Flood irrigation

Lower labor costs

The Zimmatic irrigation system is automated, so no one has to move pipes, or open and close floodgates. There are no ditches to maintain for pivots. One person can operate as many as 25 pivots, and with remote control and monitoring options, they can easily do it during the normal work day.

Low Energy Precision Application (LEPA) nozzles

Higher return on investment

The long lifespan of your Zimmatic pivot or lateral system saves you money year after year: You will use less water, and reduce waste by applying chemicals and fertilizers more accurately and evenly. It all adds up to consistently higher yields and lower input costs.

Pivots/laterals v. drip

Fewer maintenance hassles and labor costs

Compared to a subsurface drip irrigation (SDI) system, maintenance is extremely simple for pivot and lateral systems. There is no emitter clogging, and no filter maintenance – it requires only a screened intake. Rodents, roots and cultivation equipment won't damage your system. There is no need to apply irrigation water to the field each year before the crop is planted and drive the entire field looking for leaks that need to be fixed. Even algae and chemicals aren't issues.

Greater return on investment

The cost of SDI may increase sharply if a field is irregularly shaped or elongated. Many factors influence the cost of SDI and growers should consult a dealer with design software to get an accurate estimate of cost.

SDI requires a higher level of management than pivot irrigation with LEPA to achieve higher yields.

Better all-around value

- Lower investment cost per acre than SDI for a savings of 20-200% - 65% lower for 123.5 acres (50 ha)
- Longer system life – 20+ years for pivot irrigation compared to 10 years for SDI
- Mortgageable and recoverable asset with realizable resale value
- Easier to finance
- Removable
- 95% recyclable materials[1]

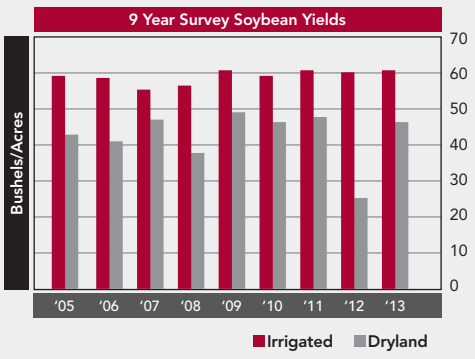
Pivots/laterals v. dryland

Flexibility of planting time; high germination rates

Pivot/lateral irrigation provides insurance against yield loss from drought or inconsistent rainfall, along with the following benefits:

- Increased yield per acre (ha)
- Precise water distribution within the whole root zone
- Precise fertilizer application to prevent deep percolation and runoff

IRRIGATED vs.
DRYLAND YIELDS (NEBRASKA)[2]



Why Lindsay?

Tough, dependable Lindsay irrigation systems have been the choice of the world's irrigators for more than 55 years. Lindsay irrigation systems pay for themselves many times over during their lifespan, and alleviate risk when weather conditions are not ideal for planting and growing conditions.

Yields: *maximized*

A Lindsay irrigation system can provide proper application to every part of a field throughout the growing season, even in those areas that are currently underutilized.

Energy, water, labor and time: *saved*

When compared to other irrigation methods, a Lindsay system will help maximize crop yields while using less energy, water, labor and time. Flexible, intuitive Lindsay irrigation control products make scheduling and operation simple, while Web-based remote control options offer comprehensive monitoring and management.

Application: *precision*

Zimmatic by Lindsay dealers analyze each grower's operation to customize a sprinkler package based on crop and climate conditions.

Downtime: *minimized*

Lindsay irrigation systems are designed and engineered for life on the farm. They're constructed using only the highest quality components for superior performance season after season.

Support: *certified*

Our network of certified dealers is trained to customize, install and service our entire range of irrigation systems.

Watertronics – Customized pump stations for maximum efficiency

Watertronics,® a Lindsay company, offers a complete, integrated pump station that helps maintain consistent water delivery from river stations, irrigation reservoirs, canals and lagoons.

Factory tested, each pump station is engineered based on your needs and field conditions to ensure peak performance.

- All components are integrated and housed in one complete unit
- Precision energy efficiency Variable Frequency Drive provides immediate energy savings
- Simple monitoring and control
- Continuous surge-free pressure regulation for enhanced efficiencies
- Horizontal and vertical pump stations available

Also available as an economical pump control upgrade for existing pumps.

IRRIGATION SOLUTIONS

Machines to fit your field

Zimmatic offers irrigation options like center pivots, lateral moves or 9500CC Custom Corner systems that can handle anything from irregular fields to rugged terrain to multiple crops.

Durability

Heavy-duty spans, trusses and advanced drivelines (Center Drive and AT Gearbox) assure long life, durable operation and deliver even water distribution. There are varying heights to provide the proper irrigation for different types of crops – proven to withstand the elements in nearly any environment.

Control panels

Depending on your needs, each user-friendly Zimmatic control panel offers a different level of control, convenience and maintenance options.

Zimmatic center pivot

The right pivot option for any field or terrain

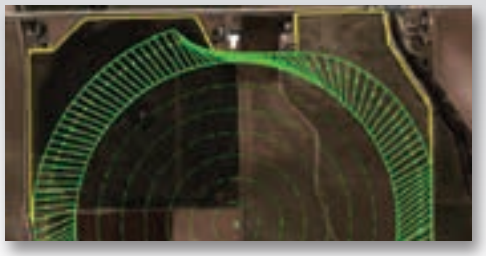
Lindsay has the pivot options to increase water efficiency and maximize yield. Lindsay offers durable parts, quality components and a range of tower heights for crop clearance and stable operation on varying terrain.

LEPA sprinklers

Operating in either bubble and spray modes, LEPA (Low Energy Precision Application) nozzles are designed to reduce surface evaporation.

Customized sprinkler packages

Lindsay custom designs every system and can provide a full range of sprinkler packages to fit your specific field/crop conditions and needs.



SmartDesign

This program allows the dealer to design and review with you an irrigation system that fits your specific field to optimize acreage utilized for increased ROI. Determine field boundaries, obstacles, system length, and total irrigated hectares to increase application accuracy and efficiency.

FieldNET®

Remotely monitor and control entire irrigation systems – from pivots and laterals to pumps and sensors – from a laptop, tablet or smartphone. Next-generation technology provides integrated water, fertilizer and chemigation management.

Zimmatic 9500P center pivot

The Lindsay Advantage

Lindsay is the only single-source irrigation manufacturer that can develop a customized pivot, lateral or drip system for your individual needs. From planning and design to wireless management, filtration and custom pump stations, Lindsay will help you optimize yields and reduce risk while efficiently utilizing resources.

Growers around the world rely on Lindsay's innovative technology and long-lasting products supported by a network of knowledgeable dealers.

To find out how to save water and energy while achieving higher yields, visit www.zimmatic.com or talk to your local Zimmatic® by Lindsay dealer.

LINDSAY™

THE LINDSAY ADVANTAGE

DURABLE • RUGGED • EASY TO USE • INTEGRATED TECHNOLOGIES • BROADEST LINE OF SOLUTIONS

ZIMMATIC™ BY LINDSAY | FIELDNET™ BY LINDSAY | GROWSMART™ BY LINDSAY | WATERTRONICS™ A LINDSAY COMPANY | LAKOS™ Separators and Filtration Solutions

2222 N. 111th St., Omaha, NE 68164 • 1-800-829-5300 • 1-402-829-6800 • www.lindsay.com

Lindsay USA: 2222 N. 111th St., Omaha, NE 68164 • **Lindsay Africa:** 25 Karee Street Kraaifontein Ind Kraaifontein, 7570, South Africa
Lindsay Brazil: Rodovia Adhemar Pereira de Barros - SP 340 KM 153, 5 - Caixa Postal 1001 CEP 13804-830, Mogi-Mirim, Sao Paulo, Brazil
Lindsay Europe: L'Epinglerie 72300 La Chapelle d'Aligné, France • **Lindsay International BV:** Weena 278, Tower B, 7th floor, 3012 NJ Rotterdam
Lindsay China Sales Office: Room 403, Building C Beijing Lufthansa Center Number 50, Lianmaqiao Road Chaoyang District Beijing, China 100125
Lindsay Australia Warehouse: Lindsay International (ANZ) Pty Ltd 19 Spencer Street Toowoomba QLD 4350

Lean, Clean and Green. Lindsay Corporation is committed to developing environmental awareness and implementing sustainable practices to reduce the use of and protect energy, water, and all other resources.

LI SOYBEAN
ENG-1422 2500 0814