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What To Do With Irrigation Pivot Corners

Helping People Help the Land

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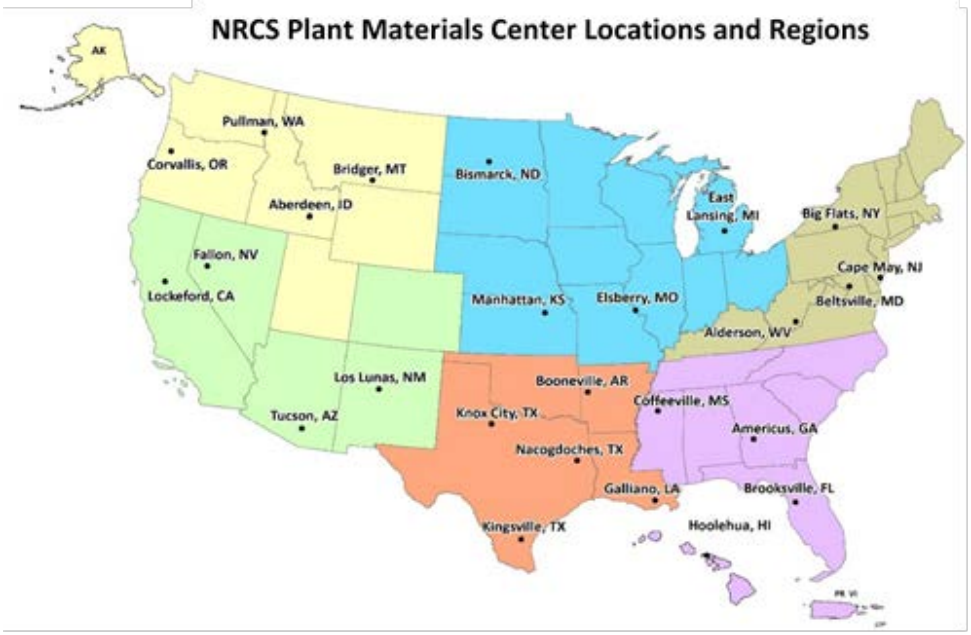
Preface

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Plant Materials Program has been involved in the evaluation of conservation plants and planting technology for more than 75 years. Unused irrigation pivot corners represent a substantial loss of useable acreage. These often neglected areas can be utilized in a variety of ways that can be beneficial to the land owner and to the land. Pivot corners may be used for alternate crops, as filters to trap sediment and nutrients, and for pollinator and wildlife habitat. Plant Materials Centers in the western US have developed technical information and species recommendations which are useful when considering what to plant in pivot corners.

For additional information on specific species of plants mentioned in this publication, please see the USDA PLANTS database at: (http://plants.usda.gov/java/) or contact the nearest Plant Materials Center or plant materials specialist (http://plant-materials.nrcs.usda.gov/contact/) and/or the Land Grant Universities that serves the State. For specific information on soils and soil health, please see USDA NRCS soils website at: (http://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/). Also, see technical resources on the National Plant Materials Program Web site at: (http://www.plant-materials.nrcs.usda.gov/).



What To Do With Irrigation Pivot Corners

In 1948, center pivot irrigation was invented as a means to improve water distribution in crop fields. This was a great improvement in water distribution compared to flood irrigation, however, center pivots have created a new dilemma: the pivot corner. Pivot corners are troublesome. Square parcels with a circular system leave unused corners that can amount to 15 to 20% of the available area in a square parcel. The result is a large portion of unused ground that could be used to help bring in pollinators, insects, wind breaks or other beneficial practices.

The most common solution to pivot corners is to leave it empty or ignored. Unaddressed corners can be difficult to manage and can quickly become a weed patch and a source of contamination to the surrounding fields. Mechanical and/or chemical fallow practices can be used to control weeds, but these are time consuming and expensive, causing the farmer to spend valuable resources managing ground with no production value or benefit.

Standard pivot circle (left) next to a pivot with a swing arm (right) near Aberdeen, Idaho. Image from Google Maps.

Technological innovations have provided a few additional options to get value out of pivot corners. Linear or lateral move irrigation systems are designed for rectangular parcels of land. End guns and swing arms extend the reach of the center pivot system into the corners bringing more land under production. The equipment for these systems is expensive, but the additional expense involved may be recouped with the increased available acreage of high value crops. Portable hand lines, wheel lines, drip irrigations systems and pod systems can also be installed into pivot corners to work in conjunction with the pivot.

An additional option is the use of smaller pivots to fill the corners and interspaces. Smaller circles situated in the corners left by larger circles effectively fill unused space providing more farmable land. Smaller pivots also eliminate the need for swing arms and provide more uniform water distribution.

Small pivot circles fill the gaps between large center pivots near St. Anthony, Idaho. Image from Google Maps.

Alternative Crops

Pivot corners can also be used to produce alternative crops that do not have as strict requirements as the primary crop. In Utah, unused pivot corners are used to grow alfalfa and alfalfa-grass hay and pasture using pod irrigation systems and hand lines. In the Mid-Western states, pivot corners are being seeded to

perennial grass production for biofuels. Grass seed production may also be an option in certain areas.

Pollinator Habitat

Unused pivot corners are an ideal location for pollinator plantings. Pollinator plantings rich in wildflowers are known to provide nectar and pollen for bees, butterflies, wasps and other insects. Many of the world's crop species benefit from insect pollination; in North America, bees pollinate billions of dollars' worth of crops annually. Nearly one quarter of our diet comes from crops whose production benefits from pollinating bees.

A diverse wildflower mix can provide food and habitat to pollinators, beneficial insects and other wildlife. Photo by Derek Tilley, USDA-NRCS.

Pollinators, including bees, moths, flies, beetles, wasps, desert bats, hummingbirds, and butterflies, are critical to the function of terrestrial ecosystems because they enhance plant reproduction. Despite their importance, pollinators are threatened world-wide by habitat loss, habitat fragmentation, improper pesticide use, disease and parasites. This has serious economic implications for humans and for maintaining ecosystem diversity and stability.

Effective pollinator plantings contain a diversity of flowers that bloom through the entire growing season to provide a steady supply of nectar and pollen. This means having flowers of different colors, shapes and sizes that blossom in the spring, midsummer and late summer to early fall.

Insectaries

Insectary plantings are similar to pollinator plantings but are used as a component of integrated pest management (IPM). These plantings are specifically designed to attract beneficial insects like lacewings, ladybird beetles, parasitoid and predatory wasps and flies to the adjacent crop for biological control of crop pests. Buckwheat, for example, has been shown to attract beneficial predatory insects that can be used to control Colorado potato beetle. Mints, daisies, Queen Anne's lace, alyssum and milkweed are also known to attract beneficial insects. Diverse floral mixtures should be used to attract a broadest array of beneficial insects.

A ladybug eating an aphid. Photo from NSF.gov

Cover Habitat and Permanent Cover

Pivot corners can be used to support other types of wildlife in addition to beneficial insects. A mixture of perennial grasses, forbs and shrubs can provide much needed habitat to support wildlife including upland birds and mammals in an ever expanding sea of agriculture. Tall-statured bunch grasses like basin wildrye and tall wheatgrass provide excellent cover for game birds such as pheasants. Trees can also be planted to provide wind protection and to serve as sheltered areas for wildlife.

Tall wheatgrass borders a wheat field providing soil stability as well as cover for wildlife. Photo by Howard Johnson.

In highly erosive soils, a permanent cover of perennial grasses can reduce wind erosion by providing a protective layer over the soil and by supporting the below ground life needed for healthy soil. Areas of permanent cover require little if any management once established. Drought tolerant grasses like crested wheatgrass, Siberian wheatgrass and intermediate wheatgrass are very effective at protecting loose soils in areas that get little to no supplemental irrigation. A mixture of bunch grasses and sod forming grasses provide structural diversity and decreases the amount of bare ground susceptible to erosion. Low growing grasses such as sheep fescue can create a clean aesthetically pleasing look with low maintenance.

Tree plantings, similar to the multi-species windbreak above, can reduce wind speeds and decrease soil erosion. They also serve as cover and nesting sites for birds. Photo by Dan Ogle.

Considerations

When working with pivot corners it is important to consider the surrounding areas. Any species planted in pivot corners should be compatible with the management strategies of the primary crops. For example, plants that serve as hosts to diseases or pests that might affect adjacent crops should be avoided. Maybe more importantly, is to consider the pesticides to be used in the center pivot field to ensure compatibility with the purpose of the pivot corner habitat. It is also important to understand the prevailing wind direction and how that will influence water availability. Downwind corners may be suitable for a certain suite of species, while upwind corners may need more drought tolerant options.

Site Preparation

Site preparation is a critical and often overlooked step in plant establishment, especially in non-irrigated systems. In the western United States, inspection of hundreds of plantings in the past 65 to 70 years have shown the most common cause of conservation seeding failures is from poor seedbed preparation. How it is approached depends on variables such as topography, project scope, site disturbance, likelihood of weed invasion, and cost. On smaller, more intensively managed landscapes like pivot corners, conventional agronomic site preparation such as disking

and plowing may be advisable. Good site preparation measures will improve seed to soil contact and stand establishment. Weed control is especially important and may require multiple herbicide applications or tillage operations to reduce viable weed seed populations.

Typical Protocols for Preparing a Seedbed on non-irrigated ground.

1) Shred or burn existing litter 2) Apply herbicides 1st spring, again in fall if green-up occurs 3) Apply herbicides 2nd spring, again in fall if green-up occurs 4) Plant new seed mixture as a dormant planting	OR	1) Plow 1st spring 2) Disk 1st fall 3) Disk 2nd spring 4) Disk 2nd fall and mechanically prepare final seedbed 5) Plant new seed mixture as a dormant planting

A firm seed bed (left) leaves a boot print approximately ½ inch deep, while a loose seed bed (right) leaves a much deeper print and needs additional firming with a packing implement. Photos by Derek Tilley, USDA-NRCS.

It is important to remember that these are starting recommendations. Each situation is different and may require variations to this starter recommendation. The ideal seedbed is uniformly firm, has soil moisture near the surface, is free from competing vegetation and is well-packed underneath with small surface clods or a light mulch of residue to prevent erosion.

See Idaho Plant Materials Tech Note 10: Pasture and Range Seedings Planning-Installation-Evaluation and Management, or Washington Tech Note 6: Seedbed Preparation and Seed to Soil Contact, for information on planning and implementing seeding projects.

Weed Control

For successful establishment, seeding fields with significant weed populations must be delayed until weeds are controlled. Refer to the Pacific Northwest Weed Management for information on herbicides that can be used for weed control during seedbed preparation and establishment. Other sources of information include extension specialists, county weed control supervisors and chemical dealers. Guidelines for Integrated Pest Management are available in the electronic Field Office Technical Guide (EFOTG) section IV, Practice Standards. Always read and follow label instructions when applying herbicides.

Species Selection
Species selection depends on a number of factors. These include the desired use (erosion control, upland bird cover, and pollinator habitat), normal annual precipitation (how much and when, or if supplemental irrigation is available), soil features and yearly high and low temperatures. Understanding these differences is key to choosing species that are adapted and are likely to establish and persist. Contact your local Plant Materials Center or Specialist or check the following references for suggestions on adapted plants in your area. Note that documents from one State may be useful for some areas in adjacent States.

Idaho
ID Plant Materials Technical Note 24. Conservation Plant Species for the Intermountain West
http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/idpmstn10793.pdf

ID Plant Materials Technical Note 2a. Plants for Pollinators in the Intermountain West
http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/idpmstn10798.pdf

Montana
MT Plant Materials Technical Note 46. Seeding Rates for Conservation Species for Montana
http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/mtpmctn12046.pdf

MT Biology Technical Note 20. Creating Habitat for Pollinator Insects
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/technical/ecoscience/bio/?cid=nrcs144p2_056662

New Mexico
NM Plant Materials Technical Note 69. Selecting the Appropriate Native Plants for Revegetation and Restoration Purposes in the Southwest
http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/nmpmctn9432.pdf

Oregon
OR Plant Materials Technical Note 13. Plants for Pollinators in Oregon
http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/orpmstn7451.pdf

Utah
ID Plant Materials Technical Note 2c. Plant Materials for Pollinators and Other Beneficial Insects in Eastern Utah and Western Colorado
http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/idpmctn11889.pdf

Washington
WA Biology Technical Note 24. Plants for Pollinators in the Inland Pacific Northwest
http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/wapmctn11733.pdf

The Colorado Plateau and Mojave Basin and Range regions of Utah are vastly different from the Intermountain Basin and Range regions of southern Idaho, eastern Oregon and Washington and western Utah. The Colorado Plateau and Mojave Basin and Range precipitation primarily occurs in the form of summer thunderstorms which supports warm season grassland communities as opposed to the cool season grasses found in the Intermountain areas. Grass species such as

purple three-awn (*Aristida purpurea*), blue grama (*Bouteloua gracilis*), Indian ricegrass (Achnatherum hymenoides), sand dropseed (*Sporobolus cryptandrus*) and alkali sacaton (*Sporobolus airoides*) are common natives on arid sites. Non-irrigated plantings are often installed in the summer in these areas in anticipation of summer rains.

In the Intermountain Region where winter snows provide much of the yearly precipitation cool season species such as bluebunch wheatgrass (*Pseudoroegneria spicata*), basin wildrye (*Leymus cinereus*) and Sandberg bluegrass (*Poa secunda*) should be selected. In these areas, dormant fall planting is recommended on light sandy to loamy soils. On heavy to medium textured soils that tend to form soil crusts over winter, early spring planting should be considered. In general, spring dryland plantings should be completed early in the spring as soon as equipment can get on the field to take advantage of spring moisture. Hopefully, seedings will have at least 30-45 days of adequate soil moisture to reach a 3-5 leaf stage. Dormant seedings may be completed any time after measured soil temperatures are below 40-45º F.

Some general rules of thumb should be applied for developing seed mixtures. For non-irrigated situations, choose 4 to 6 species (6 to 10 for wildlife habitat) of diverse type and structure. Adding additional species generally increases cost but does little to increase overall diversity. Be mindful of compatibility issues. For example, will one species crowd out other species. You should also be aware of recommended seeding depths for each species. When using a seeding drill, deep seeded species and shallow seeded species should be planted separately, if possible. If separate seeding is not feasible, then the shallower depth should be used.

Extra consideration should be used when combining native and introduced species together. This practice is generally not recommended, as introduced species are very competitive and may out-compete native plants. However, introduced forbs such as alfalfa, blue flax and small burnet can be successfully established with native grasses.

When not addressed thoughtfully, pivot corners can represent lost benefits from unused space, and can become an eyesore and increased workload. However, several options are available to utilize this space to the benefit of the land owner and local ecosystems.