ENH987

UF UNIVERSITY of FLORIDA
IFAS Extension

Seed Production of Blanketflower[1]

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Species Description

Two species of *Gaillardia* are considered native to Florida. *Gaillardia pulchella* Foug., commonly called blanketflower, is the most widely known and cultivated. It is also referred to as Indian blanket and firewheel. The lesser known species is lanceleaf blanketflower (*Gaillardia aestivalis* (Walter) H. Rock.), which is not as showy and not commonly used in landscapes. Blanketflower occurs mainly in coastal counties (13) because it is a salt-loving plant (halophyte). However, it also inhabits prairies, sandy open sites, and roadsides throughout Florida (6).

Blanketflower is an annual to short-lived perennial that is about 1 to 1 1/2 feet tall and about as wide under natural conditions. Under cultivated conditions it can spread out to over 3 feet wide and grow up to 2 feet tall. It has light grayish green leaves that are densely hairy. Peak flowering in Florida is from May through August, with diminished flowering until frost. In south Florida, blanketflower can bloom at any time of the year. Flowers are about 1 1/2 to 3 inches in diameter. The brightly colored petals are typically bicolored, with an inner band of red surrounded by an outer yellow band (Figure 1).

Figure 1. Blanketflower derived from a naturally occurring population in Florida that was planted on a central Florida roadside. Note the wide variety of flower colors. Inset - typical flower color. Credits: Roadside image courtesy of William Moriaty, Florida Dept. of Transportation.

Relative amounts of red and yellow can vary considerably among plants in natural populations (Figure 1). Occasionally flowers have petals that are entirely red or yellow. Red and white "rose colored" flowers also occur, with pure white flowers occuring rarely.

1. This document is ENH 987, one of a series of the Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date December 2005. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.

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Seed Origin

Seed originating from naturally-occurring populations and that has not been subjected to a process of selecting for desirable traits is commonly referred to as Florida ecotype, "Yellow Tag (natural track)", or "Source Identified (natural track)" (3). For additional information, see **Seed Testing and Certification**. To receive this designation, the grower must have the seed crop certified as to the Florida county of the original, naturally-occurring population(s). This type of seed commands a high price because plants derived from this seed are adapted to Florida's climate. Being adapted to Florida's climate means that these plants should perform better in noncultivated sites—like roadsides, meadows, and natural areas—than plants derived from other regions of the country. Moreover, since these plants are adapted to Florida's climate, the current thinking among many in the scientific community is that Florida ecotypes should be grown in Florida.

Two excellent articles that address the issue of seed origin in detail are "Genetic Principles and the Use of Native Seeds -- Just the FAQs, Please, Just the FAQs" (3) and "Native Seeds in Commerce: More Frequently Asked Questions" (4).

Establishment and Maintenance

Blanketflower can be grown in a traditional field planting (Figure 2) or in a landscape fabric system (Figure 3). While a traditional field planting is a less expensive option, potential yields should probably be greater with a landscape fabric seed production system based on the yield data obtained from Florida growers.

In a landscape fabric system, plants are grown in narrow rows created by a 2- to 4-inch gap between parallel strips of woven landscape fabric. Plastic film is discouraged because it will limit rain from reaching the roots. Also, rain water could pool on the plastic and wash seed away. While plastic is less expensive than woven fabric, plastic might only last 1 year, whereas fabric could last 5 to 7 years.

Figure 2. Field planting of a blanketflower seed crop.

Figure 3. Blanketflower seed crop in a multi-species landscape fabric system. Credits: Courtesy of Joe Melton.

Site Selection

Select a site with the goal of minimizing weed growth. For more information about weeds, see **Weed Control**. Identify weeds in and around the site prior to planting so that you know what weed problems might be encountered and can plan on practices to control them. To minimize weed growth:

- Choose a site with a sparse weed population. At sites where weed growth is dense, there is probably a substantial weed seed bank in the top 2 to 3 inches of soil. Inhibiting germination and growth of weeds at sites that strongly support their presence could be costly or futile. However, sparse weed growth could be due to extremely compacted soil.
- Avoid sites with heavily compacted soils as well since making these sites suitable for production could be costly.

- Avoid sites with a considerable amount of yellow or purple nutgrass (*Cyperus esculentus* and *Cyperus rotundus*, respectively). These species spread rapidly, are extremely competitive, and are difficult to eliminate.

- If the site is in turf, choose an area where the turf cover is thin or moderate. Avoid areas of thick turf. While grass herbicides can help control grasses, site conditions that support thick turf would probably favor weed growth as well.

Site Preparation

Most aspects of site preparaton are similar for both traditional field plantings and landscape fabric systems, and for both seed and transplant establishment of the production site.

Minimum Till. About 4 weeks before planting, kill existing vegetation with a nonselective, translocated herbicide that contains either glyphosate or glufosinate as the only active ingredient. More than one application will probably be needed to kill the weeds so make the second application about 2 weeks after the first one. About 2 weeks after the second application, mow the dead vegetation down close to the soil and either bag the clippings, direct the mower discharge so that clippings are discharged off the planting site or, if permitted, burn off the dead vegetation.

Using Seed

Field planting. Lightly scarify the field with a disk or harrow so that the soil surface is barely scratched. Disking or harrowing at least one time in a perpendicular direction will increase the amount of soil surface that is scarified. Lightly scarifying the soil facilitates good seed-to-soil contact while minimizing the soil disturbance that creates weed problems. Disking or harrowing will not be necessary if a no-till drill is used to sow the seed, and will probably not be necessary if the soil is sandy. However, if the seed bed soil is loose, it will have to be made firmer. A turf roller or cultipacker can be used to firm up the seed bed.

Landscape fabric system. Delineate the row locations and then lightly disk or harrow the rows only. If the soil is loose, only roll or cultipack the rows.

Using Transplants

No further site prepartion is necessary, unless irrigation will be installed, which is discussed at the end of this section.

Deep Till. While the minimum till method avoids weed competition by reducing soil disturbance, the goal of the deep till method is to substantially deplete the weed seed bank in the soil. This method will result in a well tilled soil and minimal weed competition, but it can take up to 2 years to complete.

Existing vegetation is killed with a nonselective, translocated herbicide containing either glyphosate or glufosinate as the only active ingredient. The field is then deep tilled and a new crop of weeds is allowed to emerge. When weed seedlings are 1 to 3 inches tall, kill them as before. Repeat this herbicide/tilling cycle for up to 2 years. Since the soil is deep tilled, it will have to be firmed up before planting, as previously mentioned.

Soil Solarization. This is a cultural method of pest control in which clear polyethylene is laid over moist, tilled soil for 6 to 12 weeks to trap incoming solar radiation, thereby heating the soil to temperatures lethal to many weed species and soil-borne pests. Several points to keep in mind are:

- Use this method only in summer or early fall, when the soil temperature is easiest to increase and maintain.

- This method will only control/suppress soil pests to a depth of 6 to 8 inches.

- Soil must be kept moist.

- Some crabgrass species may not be controlled.

Additional information about this technique can be found in Florida Cooperative Extension Service publcation ENY625, "Nematodes and Their Management" (http://edis.ifas.ufl.edu/CV112).

Once the soil is prepared, consider installing an irrigation system so that plants can be irrigated during extended dry periods. Flowering season of natural stands is extended when rain occurs regularly. And just as important, water stress may affect seed yield and quality. While an irrigation system is certainly beneficial, the cost of installing a new one for a field planting may be prohibitive and therefore not practical.

Planting

Seed

Sow about 1 lb Pure Live Seed per acre in late summer or early fall while temperatures are warm and before the end of the rainy season. This seeding rate should yield a stand dense enough to help reduce weed competition. Best stand establishment will occur with frequent rain or supplemental irrigation for the first 2 to 3 weeks after seed is sown. Seedlings (Figure 4) will form rosettes and remain at this stage until the weather warms up in the spring.

Figure 4. Blanketflower seedling - 11 days old; magnification=7X.

Field Planting. Production fields can be established as solid stands or in rows. Space rows far enough apart so that you can use a cultivator to control weeds.

A no-till seed drill, if available, can be used to plant large, solid stands. Because of the fluffy nature of blanketflower seed, use a no-till drill with straight drop tubes. Seed can get clogged in curved drop tubes. To obtain spaced rows, cover the drop tube holes in the seed drill hopper that are necessary to obtain the desired row spacing.

Good seed-to-soil contact is critical for optimal germination. Therefore, if seed is not planted with a no-till seed drill, cultipack or roll the seed bed, or simply scratch the seed into the soil with a rake. Best seedling emergence should occur when seed are in the top 1/8 to 1/4 inch. Seed buried deeper than 3/8 inches might germinate but seedlings might not emerge.

To uniformly distribute seed by hand over an entire small plot (less than 1 acre), mix half the seed with slightly moistened sand or a similar inert material. The ratio of sand to seed (by volume) should be 9:1 or greater. Spread this half of the seed over the entire plot, and then repeat the entire process with the other half of the seed. Incorporate the seed as decribed above for good soil-to-seed contact.

Landscape Fabric System. Sow seeds with a mechanical planter to ensure even distribution within the narrow row. After the seed is sown, incorporate the seed into the top 1/8 to 1/4 inch of soil by rolling or simply walking down the row in flat-soled shoes.

Transplants

Plant seedlings in early fall so they can develop a good root system and harden off before the first frost or freeze. However, in south Florida, transplanting by mid-December should be acceptable. Seedlings to be transplanted should have a well-developed root system (Figure 5) but not be root bound. Space plants 12 to 18 inches on center; use closer spacing on sandy soils. Seedlings will require frequent watering (rain or supplemental irrigation) for the first 2 to 3 weeks after transplanting.

Fertilization

Currently, there are no IFAS fertilizer recommendations for blanketflower seed production or for any other wildflower seed crop. Moreover, while there is no evidence of beneficial effects of supplemental fertilization on seed yield or quality of blanketfower, fertilization increased yield of Florida ecotypes of coreopsis by increasing the number of flowers per plant (9, 10). Decisions about

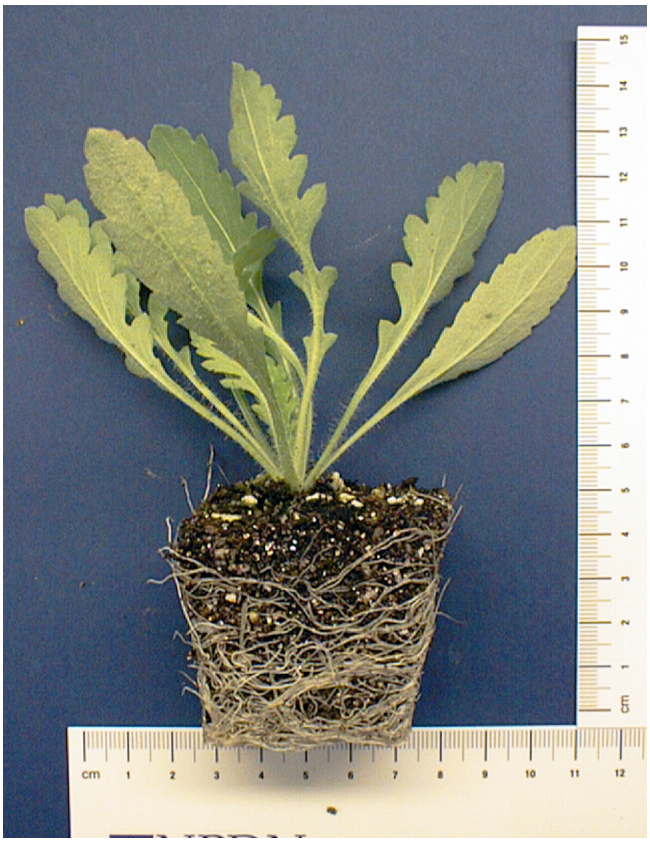

Figure 5. Blanketflower seedling ready for transplanting to the field. The seedling is nearly 4 inches tall. Credits: Courtesy of Jim Aldrich, University of Florida/IFAS.

fertilization should be based on a soil test, which should be conducted annually to determine levels of phosphorus (P) and potassium (K). If you decide to fertilize, apply a fertilizer with a low N, low to no P, and high K ratio (for example, 5-0-20 or 5-5-20). And consider that excess nitrogen may promote vegetative growth over flower production.

Since blanketflower has a long flowering season, use a fertilization regime that will result in nutrients being available through early fall. Begin fertilizing in late February or early March. If a fertilizer is not used the first year, it's likey that supplemental fertilization will be needed in subsequent years.

A controlled-released fertilizer (CRF) can be used for rows that are more than 3 inches wide in landscape farbric systems. If a drip irrigration sytem has been installed, fertigating will provide more uniform distribution of nutrients to the crop than a CRF.

Lime

There is evidence that some ecotypes of blanketflower prefer limey soils (2). Consider experimenting with adding lime to the soil on a small portion of your planting. Keep the seed harvested from your experimental plot separate, and have it tested separately as well.

Irrigation

If economical, use supplemental irrigation to ensure that plants receive at least 1 inch of water per week. When irrigating the crop, apply at least 3/4 inch each time to encourage a deeper root system.

Weed Control

Weeds are usually the major pest problem in wildflower seed crops. They can reduce seed yield by competing with the crop for water and nutrients. And just as important, marketing of the seed will be difficult or impossible if there are too many weed seed mixed in with the crop seed. Be especially thorough when eliminating noxious weed species (1) from your planting. Seed of noxious weed species mixed in with blanketflower seed will severely limit your ability to sell or distribute your seed, and might even prevent it. For example, the Florida Department of Transportation has zero tolerance for noxious weed species in wildflower seed that they purchase.

Weed control is a major consideration when deciding whether to direct seed or use transplants. Direct seeding is much less expensive than using transplants but there are no herbicides currently labelled for use on seed beds used for wildflower seed production. Hence some costly handweeding will probably be necessary the first year. The advantage of using transplants is that preemergence herbicides can be used soon after transplanting (see **Chemical Weed Control**).

Under good growing conditions, blanketflower is very aggressive and will choke out most weed growth, except for tall, mainly single-stemmed weeds that tend to emerge from small gaps in the blanketflower canopy. However, even if weed competition seems minimal and the crop is thriving, use practices that will prevent weed seed contamination of the crop seed.

Cultural Practices. In direct-seeded plots, especially for the landscape fabric system, handweeding will be necessary until seedlings are large enough to permit use of a preemergence herbicide or postemergence grass herbicide. In transplant plots, some handweeding might be necessary even if a preemergence herbicide was used. For example, nutgrass (*Cyperus* spp.) often is not controlled and must be removed manually or sprayed with a nonselective postemergence herbicide. Eradicate nutgrasses as soon as possible because they can quickly spread.

Mowing can be used to keep weed growth in check as well, but mow weeds before they flower and go to seed. Production plots can be mowed until blanketflower starts to bolt or becomes too tall to remain under the blade. Also, mow the area surrounding the seed production area often enough to prevent weeds from flowering.

For field plantings grown in rows, weeds in aisles can be controlled by cultivating before weeds start flowering.

Chemical Weed Control. If chemical weed control is to be part of the weed management program, use a preemergence herbicide. Preventing weed growth is usually less expensive than killing existing weeds. Dacthal®, Pennant Magnum®, and Trilin®4EC are preemergence herbicide products currently labelled for use on *Gaillardia* species in general. While these herbicides should be safe to use on blanketflower, herbicide tolerance can vary depending on seed source and growing conditions. Testing these herbicides on a small portion of the planting prior to widespread application would be prudent. Check for injury for 1 to 2 months after application.

Grasses growing in or around crop plants can usually be controlled with postemergence application(s) of a grass herbicide. The only postemergence grass herbicide product currently labelled for use on *Gaillardia pulchella* is Vantage; Acclaim® Extra is labelled for *Gaillardia* species in general. Like the preemergence herbicides mentioned above, these should be tested on a small portion of the crop prior to widespread application.

Existing annual and perennial broadleaf weeds or nutgrasses can be controlled by directed applications of a nonselective herbicide that contains glyphosate or glufosinate as the only active ingredient. Small or immature weeds can be killed with a directed application of a contact herbicide that contains diquat or an herbicidal soap as the only active ingredient. Whenever applying nonselective or contact herbicides, use a shielded spray nozzle to reduce the likelihood of spray drift damaging the crop.

Whenever using any herbicide, read and follow all label directions, including those for protective safety equipment and re-entry intervals.

Other Pests

No significant insect pests have been observed on blanketflower crops. In an isolated example, a bacterial spot was observed during late spring, when rain ocurred almost daily for a few weeks. However, when rain frequency declined, the plants recovered.

Stand Longevity

Blanketflower is a good seed producer. Since all seed cannot possibly be harvested, and it can be a short-lived perennial, replanting should not be necessary. However, to help preserve the genetic diversity of the original planting, store some of the seed used to establish the original crop and re-introduce some of the original seed (or transplants) into the production plots every 2 to 3 years.

Harvesting Seed

The mature seed head resembles a light gray, fuzzy ball (Figure 6). Each seed is actually an individual fruit called an achene. Blanketflower achenes (Figure 7) strongly resemble the "birdie" or shuttlecock used in badminton, with the black seed buried deep at the tip.

Many of the ripe achenes will drop off the seed head on their own. However, those that are retained (this percentage could be substantial) must be dislodged at harvesting or after the drying process. Seed can be dislodged from dried seed heads using a hammermill (12). For small quantities of seed, try

Figure 6. Mature blanketflower seed head.

using a food processor with the blades wrapped in duct tape (11).

Figure 7. Mature "seed" (achenes) of blanketflower.

A combine is most cost efficient when harvesting field crops of 10 acres or more. A combine will harvest the whole crop, whether the seed is mature or not. Plants should reflower, allowing at least a second harvest. An alternative method to harvest seed from field plantings is a modified leaf vacuum pulled by a tractor (5). This method has not been used to harvest blanketflower seed but was designed for harvesting fluffy seed like blanketflower seed.

Using a handheld seed stripper allows for more selective harvesting. Manually harvesting with pruning shears is the most selective method because seed heads comprised of mostly ripe seed can be harvested.

When seed heads are being harvested from a small plot for increasing seed or for seed packets, harvesting by hand is strongly recommended. Hand harvesting, while labor intensive, will maximize yield (8). Moreover, since only ripe seed heads are being harvested, plants will continuously flower throughout the growing season thereby maximizing seed production.

Harvesting Ripe Seed Only

The landscape fabric system allows for harvesting of a crop that contains only mature seed. Many ripe seed will fall off the seed head and onto the fabric. Vacuum the seed off the fabric several times per week as they could wash away in a storm or be blown away. Black landscape fabric can also get quite hot (over 160^{o}F on a sunny day), so exposure of the seed to this heat needs to be minimized. For small production areas, sweeping up seed with a broom might be efficient as well.

Postharvest Drying

Harvested seed, especially seed harvested by combine, will contain some leaves, stems, and immature seed. Seed must be dried before they are cleaned, and just as important, dried relatively quickly. If the plant material remains moist too long, seed will start to decay.

Harvested seed can be spread on a clean, hard surface and allowed to dry for a few days before cleaning. Use a floor fan to facilitate drying if the harvest is large. Laying the harvested seed on brown packing paper or newspaper in a shed or barn should be adequate. (Visit your local newspaper and ask for the ends of newsprint rolls.) If drying seeds outdoors, seed can be blown away in windy weather, and dew and rain will slow the drying process.

An alternative method is to dry the seed in a drying bin (Figure 8). A simple seed drying bin consists of four plywood walls and a porous false bottom, with warm, dry air (<100°F) forced up through the bottom. Some growers use a furnace fan as a source of warm air. Openings in the false bottom need to be small enough that seed do not fall through. Spread seed out evenly (and not too thick) over the entire floor of the bin. If part of the floor is not covered with seed, the air will preferentially flow through that gap and increase drying time.

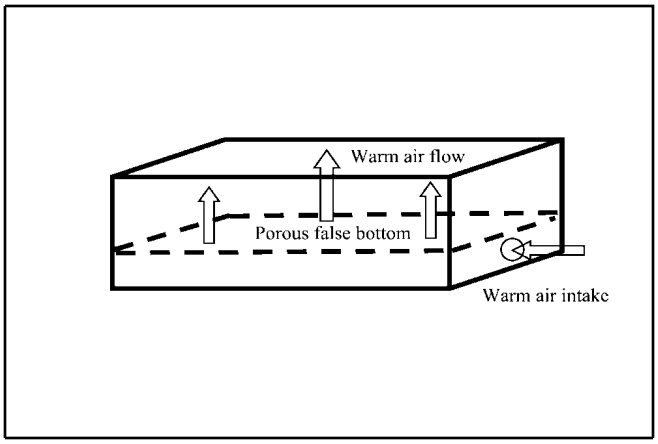

Figure 8. Diagram of a simple seed drying bin.

Cleaning Seed

Cleaning blanketflower seed has proven to be a challenge for Florida producers. Because of the fluffy nature of the seed, removing unwanted plant parts and weed seed is difficult. There is no known method of safely and economically extracting the actual seed from the tip of the shuttlecock-like achene.

Use a two-screen (or more) air-screen cleaner initially. Consider these options for additional cleaning:

- A seed cleaner that utilizes some type of fabric. The fuzzy achenes might stick to the fabric more than other plant parts or weed seed. This seed cleaner would also need to have a mechanism for safely dislodging seed from the fabric.
- Air density seed separator - This type of cleaner is best for separating ripe seed from immature seed or seed that do not contain an embryo.

Small quantities of seed can be cleaned by hand with screens used in an air-screen cleaner. Screens can be purchased for about $35 each.

Seed Storage

Store clean seed in a cool, dry environment such as a large refrigerator or walk-in cooler for maximum shelf life. The current rule of thumb is that temperature (°F) + relative humidity (% RH) in the storage facility should total 100 or less. For example, storing seed at 35°F and 40% RH (35+40=75) would be adequate.

If seed is going to be stored in a shed or barn, protect it against insects and rodents. No matter where the seed is stored, each bag should be labeled with the species name, date of harvest, date of storage, percent purity, and germination rate.

Seed Testing and Certification

Purity and germination tests must be conducted prior to sale. A viability test, which is best when conducted independent of the germination test, is strongly recommended. Total cost for these tests is about $90 or more for each wildflower seed crop that will be sold. A viability test is sometimes accepted in lieu of a germination test because optimal germination conditions for Florida ecotypes of blanketflower may be different than commercial germination protocols for blanketflower. However, Florida state seed law currently requires that germination test results appear on the label.

Labs that specialize in testing native species:

Mid-West Seed Services, Inc.
236 32nd Avenue
Brookings, South Dakota 57006
(877) 692-7611
info@mwseed.com
http://www.mwseed.com

Ransom Seed Laboratory, Inc.
PO Box 300
Carpinteria, CA 93014-0300
(805) 684-3427
Ransomsl@silcom.com

http://www.ransomseedlab.com

Some buyers may require that the seed be certified as being Source Identified by the Southern Seed Certification Agency, a joint agency of Florida and Alabama. Certification currently costs $250 per year, regardless of the number of species to be certified, plus $0.10 per pound of seed to be sold.

Southern Seed Certification Association, Inc.
PO Box 2619
Auburn, AL 36831
(334) 844-4995
http://www.ag.auburn.edu/aux/ssca

Costs

Detailed information about costs is in the Florida Department of Agriculture Publication "Native Wildflower Seed Production in Florida" (7).

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