

Seedballs: An opportunity for low-cost, community-based riparian revegetation



Celebratory first throw of seedballs onto a restoration site. The group then split up to disperse the seedballs evenly across the site.



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Background

In northwest Colorado, the White River provides crucial habitat for native, endangered, and conservation agreement fish species and its riparian corridor provides habitat for elk, deer, and other terrestrial wildlife. Socially and economically, the White River is the lifeblood of Rio Blanco County's agricultural communities and growing outdoor recreation tourism.

Tamarisk and Russian olive (TRO) are invasive plants that are establishing throughout the White River corridor, increasing the threat of wildfire, inhibiting access for recreation and grazing, and diminishing habitat for native aquatic and terrestrial wildlife. The White River Partnership (WRP) is a multi-stakeholder group that is committed to restoring and maintaining healthy riparian areas along the White River in northwest Colorado and northeast Utah through collaboration among public, private, and non-profit entities. WRP partners in this project include RiversEdge West, Rio Blanco County 4-H, 4M Ranch, Bureau of Land Management White River Field Office, Colorado Northwestern Community College, Western Colorado Conservation Corps, and Yampatika.

With support from the Colorado Watershed Assembly's Healthy Rivers Fund we held a seedball event on the White River in Rio Blanco County, CO in Fall 2022. While there are some good resources (links below) already available about seedballs, we felt it would be helpful to describe how we hosted this event with a focus on community engagement and share lessons learned about seedball making and our plans to monitor the success of these projects. We hope this is helpful to other groups interested in working with youth on riparian restoration projects.

We're grateful to the Bureau of Land Management (BLM) and Rio Blanco County for providing a location to host this event. This revegetation effort is a part of larger, ongoing riparian restoration projects that are coordinated through the White River Partnership. This restoration site has also received support from the Colorado Water Conservation Board, Bureau of Reclamation, and the BLM.

About Seedballs

Seedballs are a mixture of plant seed, plant nutrients, and a binding agent mixed with water and formed into a ball. The specific ingredients can vary, but the principle behind the seedball is to increase seed to soil contact, retain moisture, and provide the soil and nutrients needed for the seeds to grow when they germinate. The seedball structure can also decrease predation by birds and rodents.

Seedball making is a great event for children. It is hands-on, relatively simple to do, doesn't require any special tools, and can be done anywhere you don't mind getting muddy. Seedball dispersing is as easy as filling buckets with seedballs and throwing them all over the area you'd like to revegetate. This event can be coupled with expanded education opportunities such as plant identification, ecology, or other aspects of ecological restoration.



Yellow bee plant growing from a seedball

Seedball Making

The basic materials needed for seedballs are seed mix, clay, nutrients/soil, and water.

For our event we made 1,000 seedballs with:

- Native seed mix (we used about 19 pounds of seed, but could have used much less)
- Topsoil mix- (2) 1.5-cubic foot bags
- Clay-we could not get the recommended pottery clay in time, so we used a natural, unscented, pure clay cat litter (2.5) 40-pound bags

During a separate seedball event, volunteers made 815 seedballs using:

- 15 pounds of grass seeds
- 1.75 cubic feet of soil/compost mix
- 40 pounds of pure clay cat litter

Tools and supplies for seedball making include:

- Watering cans
- Parchment paper
- Large, sturdy cardboard pieces



4H students making seedballs

- (5) 5-gallon buckets
- 20-gallon bins for mixing the dry ingredients before putting them into the buckets

Seed mix

The seed mix you select will depend on your restoration goals and local conditions. Our site was a riparian area in northwest Colorado. Prior to seeding, invasive tamarisk and Russian olive trees had been removed. We did a survey of plants that were already colonizing the area and excluded those species from our mix. Our goals with our seed mix were to provide some pollinator habitat and expand the forb and shrub species in addition to the grasses and forbs already present on site.



Seedballs drying

In selecting the species for the mix, we consulted the Ecological Site Description for the area using the University of New Mexico’s Ecosystem Dynamics Interpretive Tool (<https://edit.jornada.nmsu.edu/>) along with some surveys of nearby sites and local knowledge. The percentages in the mix were also determined using the Ecological Site Description of percent distribution of life forms. Other resources include local wildlife managers, extension offices, seed suppliers, or restoration-focused nonprofits in your area.

After our species were selected, we needed to calculate the amount of seed to order. Because seed balls are not designed to uniformly cover an area, the amount of seed was initially more complicated to assess. Our entire site was 8 acres, and we started with our seed at \$850/acre. We ramped this number down substantially and ended up purchasing 20lb PLS for seed balls on the entire site, which approximately equates to 40 seeds/ft² for 5 acres. Our site had some good regeneration of grasses already, so this reduction was reasonable. If the site were bare, we would have ordered more seed.

We learned that some seeds, especially grass seeds, can be very sharp and require gloves or very careful mixing. For events with children, we recommend avoiding seed mixes with mostly grass seeds. One constraint to your seed mix is the budget. Forbs and shrubs can be expensive, and prices change regularly, so budget accordingly.

Ratio: We used an (approximate) ratio of 1:2:3 of seed:clay:nutrients at the recommendation of the Gornish Lab at the University of Arizona, which we found to work well. Other resources online suggest a ratio of 1:3:5 of seed:nutrients:clay. Based on initial monitoring and other studies, we would consider reducing the amount of clay in the next batch so the seedballs break down more easily and don’t trap the seeds inside.

Mixing

Staff members premixed the dry ingredients (seed, soil, and cat litter) in a 20-gallon tote, and then separated it into 5-gallon buckets, filling each bucket $\frac{1}{2}$ to $\frac{3}{4}$ full. This made it easier for groups of 4-5 students to have small workstations around each bucket. Students added water to the mix using watering cans.

Making

Staff instructed students to aim for a “cookie dough” consistency when mixing in the water, which seemed to resonate.

The sizes of the seed balls varied by participant, but we suggested a little smaller than golf-ball sized. If balls get too big, there can be lots of seeds trapped in the middle that never break out of the clay binding. If balls are too small, they have a harder time absorbing and holding moisture. Making seedballs takes between 1.5 and 3 hours.

Drying and Storing

We placed the seedballs on top of parchment paper to prevent them from sticking, and that was on top of sturdy cardboard to make carrying the seedballs to the drying area easier. We let the seedballs dry for 1 week indoors.

Dispersing

We made about 1,000 seedballs in total. On the seedball throwing day, we separated them into buckets for the students to carry around on the site. For this day, we had some help from the local community college’s environmental science class. It took about 2 hours to throw all of the seedballs and walk back to the vehicles.

Monitoring

There is not a lot of research on what drives successful seedball efforts, and monitoring can be expensive and time consuming. Some research has shown that seedball emergence can happen in later seasons (Jones et al. 2014, Barry 2022). Our monitoring goals are to answer the following questions:

- How many seedballs germinate?



College students throwing seedballs on a restoration site



4H students throwing seedballs on a restoration site

- Does shading affect seedball germination success?
- Which size seedball was the best for germination?
- Does ground cover affect seedball germination success?
- Are grasses, forbs, or shrubs more likely to germinate from seedballs?
- Should the seed ball remain an intact ball, or does a little bit of impact or breakage in the ball increase germination?

We developed a monitoring form that can be utilized with little previous training. There are two forms, one is printable as a Microsoft Excel Sheet (in this report as an appendix), the other is an ArcGIS online form that contains pre-filled selections for each column (<https://arcg.is/0mqqim>).

Seedballs can be difficult to monitor because they blend into bare ground and can get covered by grasses and other vegetation over the summer. We recommend placing numbered pin flags next to seedballs as soon as possible after they are dispersed, and we always bring a few pin flags each time we visit the site to mark additional seedball locations. Make sure the landowner or manager of the site is OK with this. It might make sense to flag only a subset of all the seedballs.



A seedball with a sprout coming out

Some notes on seedball effectiveness and additional resources

Seedball making and dispersing provide excellent opportunities to engage community members of all ages in restoration projects. To date, there is little formal research as to which ingredients and mix ratios are most effective for establishing native plant communities. The Gornish Lab, at the University of Arizona, has long-term seedball projects in arid landscapes and provides a lot of background information on their webpage. Barry (2022) provides a summary of seedball research, including that seedballs may have higher germination rates in subsequent years as the seedball structure continues to break down. Kannan and others (2021) provide a short history of seedballs and highlight their usefulness not only for ecological restoration but also for agriculture.

For more information and research on seed balls, we found the following resource to be very helpful:

- Barry N. (2022). Environment, habitat, and seed modifications as restoration techniques to enhance dryland revegetation success. <https://www.proquest.com/openview/fb37c6e3b8325ff5b46e25b458537819/1?pq-origsite=gscholar&cbl=18750&diss=y>
- Gardening Know How: <https://www.gardeningknowhow.com/special/children/making-seed-balls.htm>

- Gornish Lab at University of Arizona: <https://www.gornishlab.com/seedballs>
- Kannan et al. (2021). Future perspective of seed ball technology for creating new ecosystem. <https://www.ijplantenviro.com/index.php/IJPE/article/view/1376/801>
- Ladybird Johnson Wildflower Center: <https://www.wildflower.org/learn/how-to/make-seed-balls>
- Seed-balls.com <https://seed-balls.com/basic-seed-ball-recipe>



A seedball resting on cottonwood leaves

Seedball Monitoring Form

Seed Ball Number	Germination: Yes or No	Ground Surface Grass, Litter, bare ground	Canopy cover Grass, shrub, tree, open	Seedball Size Small, Medium, Large	Broken or Intact?	What appears to be germinating? Grasses, forbs, shrubs

	Description	Drop-down menu options
Seedball Number	If marking specific seedballs	n/a
Germination	Did germination occur?	Yes No
Ground Surface	Surface the seedball is on top of	Bare Ground Litter Grass
Canopy Cover	Is anything above or shading the seedball?	Litter Grass or Forb Shrub Tree Open
Seedball Size	How large is the seedball?	Small (Golfball or smaller) Medium (golfball to baseball) Large (baseball or larger)
Broken or Intact	Is the seedball intact or smashed/broken	Broken Intact
Germinating Plants	Can you identify which plants are germinating?	No Germination Grass Forb Shrub Tree Grass and Forb Grass and Tree Forb and Tree Grass Forb and Tree
Date Monitored	Date of monitoring	n/a