

Natural Seeds and Seedballs: As Game Changers for Growing Food

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Seedballs are small balls usually made with clay, compost and several seeds. There are several recipes for making them, some are very high tech. In any case, the idea is the same: to facilitate the planting of seeds. Protecting the seeds and providing the seedlings with a starting fertilizer. Cayenne pepper is usually added to Seedballs to repel insects and rodents. And the small amount of fertilizer in the Seedballs helps the young seedlings during the crucially important first weeks of their growth. Seedballs are made using all kinds of methods and vary greatly in size. From a diameter of 1 cm in Europe to more than 5 cm for those made in India. The size of the Seedballs is adjusted to the size of the seeds used.

Originally Mr. Masanobu Fukuoka, the inventor of Seedballs, used them to sow rice without having to plow his fields. He got record yields and that made him famous worldwide. His book explaining his technique was translated into 25 languages, which led him to give lectures all over the world. Having spent all his life on his small island in Japan, and surrounded by fertile lands, Mr. Fukuoka was horrified to see how the ecosystem of the planet was damaged and turning into desert. During his travels in Africa and India, he was also very sad to witness the amount of people starving.

Following meetings with officials from various governments and international organizations, he had the idea of launching Seedballs by airplane to plant trees with food plants. You could say he was a forerunner of the Food-Forests movement that want to change our farming's methods to one that is resistant to climate change. He used airplanes to plant a wide mixture of seeds in India. And also worked on several projects in Africa and Thailand. But his plans were interrupted by the Iraq war. Unfortunately, it was then too old and died before accomplishing his dream to regenerate Nature and feed the world.

Today Seedballs are commercially successful in Europe and the United States as a way to plant flowers for the bees. In India they are used by tens of millions to fight global warming by planting trees. In Pakistan they are beginning to be massively used after successful trials to regenerate the biodiversity of a large national park. In Africa they use millions of Seedballs to plant trees, grasses and millet in desertic regions. Several companies around the world want to plant billions of trees with Seedballs and drones. Seedballs are particularly suitable for replanting after wildfires, or in desert areas. In tests I did with an agronomist, what surprised everyone was the ability of Seedballs to grow in hostile conditions. I also had great success growing vegetables and flowers in tests I did on an Organic farm.

Seedballs are considered by the German University of Hohenheim to have the potential to improve the living conditions of millions of small farmers that are living in arid areas. They are carrying out an ambitious Seedballs test program with 3000 African farmers. In the very difficult conditions of the Sahel countries, they managed to greatly increase the yields of Millet crops (the only cereal that can survive in this desertic area), while at the same time reducing the workload for the farmers. Production of Seedballs is also seen as an opportunity to create small business for African women, because they can be made outside of the farming season, while there is less work. There is however a lack in the tooling needed to manufacture Seedballs. This type of tool must be very inexpensive and adapted to the almost total lack of access of modern technology for these peoples. This is that type of tool that I am developing.

The easiest way to make Seedballs is to roll them by hand, that way it is possible to make a few hundred per day. One way to produce large quantities is to use a cement mixer. But there is a lot of problems with this method. Two of the main problems is that it is very

difficult to control the size of the Seedballs and the quantity of seeds in each of them. This is not necessarily a problem. Many wildflower seeds are inexpensive and the number of these seeds in each Seedball is not critical. But when it comes to vegetable seeds it's another story, not only are these seeds more expensive, but for agronomic reasons it's essential to keep a close check on their number in every Seedball. Cement mixer methods, using a much smaller rotating container, can be effective in making mini-Seedballs from 4 to 5 seeds. This type of seed pellet is seen more and more in garden centers for seeds of kale seeds and basil for example. But these mini-Seedballs contain no fertilizers and one of the main interests of Seedballs is their content in fertilizers (Compost and other fertilizing materials). There is also a Seedball tool designed by the university of Hohenheim.

There is an often-misunderstood concept about Seedballs: there are several seeds in each Seedball. Seedballs is often confused with seed coating. In seed coating you take a single seed and surround it with different products. The coating can be used to enlarge or standardize the diameter of a seed to facilitate planting using sowing machines. The coating can also be used to protect the seed from various diseases or insects. In the case of Seedballs we are going to grow not a single plant, but a bunch of seedlings. This small group of plants growing together will have both a protective and a competitive effect. At the start of growth, especially in difficult conditions, having more roots growth will facilitate the penetration of the soil for the young seedlings roots. There is also a wind protection effect. For example, in desert conditions where the wind is blowing grains of sand, the plants at the edge of the bouquet will protect those in the center. When the plants grow some more, an automatic natural selection will happen, like what happens in the way that many wild plants grow. The strongest or luckiest individuals will dominate and get to form a mature plant, while the others disappear.

Another concept that is not simple to understand is the optimal quantity of seeds needed per square meter of cultivated area. Over 40 years ago, when I started a small vegetable growing business, I was fortunate enough to rent land from a 70 year old gentleman who had grown vegetables commercially all his life and whose father has also been a market gardener. On the same farm there was also another retired multigenerational vegetable farmer, who was also renting a small plot of land. I was surrounded by two master gardeners who showed me several things that are not found in books. I came from a family of scientists and inventors with no connection to the agricultural profession. At first I was scrupulously following instructions that I found in books. I learned that in order to optimize vegetable production it was necessary to plant seeds at very specific distances. But I saw my two old farmers friends doing the exact opposite and using a lot, and I mean A LOT MORE seed than me. And they generally got better results with their crops. What struck me when I questioned them about abundant usage of seeds was that they said that "seeds have become expensive nowadays". They had seen the days before seed industrialization, and the race for pure varieties giving highly uniform plants to facilitate mechanized operations. Modern seeds are expensive, and the price is not going down.

In the last few years during my research to optimize Seedballs manufacturing, I sought to minimize the number of seeds per Seedballs, in order to use them for agricultural production (moreover, I had great results at this level). Since I was mainly working on a tool to make Seedballs, I made a lot of test Seedballs and I started running out of seeds. It was then that I used an old batch of seeds and made a discovery that made me think of what the old farmer had told me. This seed lot was old and I did not trust its germination percentage, so I tripled the amount of seed in each Seedballs. But these seeds germinated perfectly. And I got beautiful bouquets of kales, pac choi and mustards. It was so beautiful that I thought it would make a great game to teach kids about gardening. It's also allowed me to observe that as in nature, there was an automatic thinning process. The strongest plants (or those most suited to this particular moment in the season or climatic conditions), will dominate and eventually give a good harvest. Without the need to do any manual thinning, just letting nature go. Like my two old teachers did.

With the Covid crisis, the room I used to make my prototype tools for Seedballs was closed. But since it was spring I still wanted to do something, I focused on two things: buying seeds and finding how I could put my gardening knowledge at the service of all these people who are lacking food. I thought that I could be good at helping people who only have a very small space for gardening. It was while thinking about this that I realized that the methods I normally use to grow vegetables commercially are not effective for small gardeners. A farmer cultivates large areas and uses machinery to reduce costs and manual labor. A small gardener does not use machinery and does all of his

operations manually. The farmer places his vegetables with a lot of space between plants to allow easier cultivation. A small gardener can use the totality of his space. The farmer needs seeds that all grow at the same rate to be able to mechanize operations and harvest all his field at the same time. The little gardener can use seeds that give an harvest distributed in time and pick the vegetables as they grow.

In ancient times gardeners used quantities of seeds which would seem completely insane for a modern gardener. For example, I have read in a gardening book dating from the 1860s that to grow melons you could use up to 30 seeds planted in a groups (a mound or a "hill" in gardening parlance). To put things in perspective, a modern gardener using expensive hybrid seeds will use between 2 and 4 seeds for a hill. And if the modern gardener sees one of his little plants pass away, it's big drama sometimes. But in ancient times one of the basic principles of gardening was to thin the seedlings. As the plants grew, they removed the less beautiful ones to make room for the ones they preferred. In the case of melons, but also corn and many other vegetables, it was normal to expect that a certain percentage of seeds would be eaten by birds and insects. In addition, since they usually used their own seeds, and the pollination was done by bees, the plants they obtained had some variability. They where used to choosing the best as they grew, by thinning out the less desirable ones, usually when weeding or cultivating the soil.

When growing salad and greens, the thinnings where eaten. Eating the thinnings that are removed to make room for the others greens to grow, is a very effective method for small gardeners. That way they can use all the space they have. If you look at how weeds grow, they usually completely carpet the soil with theirs small seedlings. But later in the season you get big plants, all the others disappeared naturally. So, I suggest that small gardeners carpet their soil with seeds. Like someone would grow micro sprouts, but instead of harvesting everything at the same time, gradually thinning the vegetables and eating the thinnings. Like it was done in the old times... Totally impossible to do for farmers, but the most efficient use of soil surface and solar energy when you think about it.

There is a fundamental difference between ancient seeds and current pure varieties. For thousands of years we have used so-called population varieties. A group of seeds that produce plants that look alike, but that are all genetically different. Such populations are very resilient to climate change. Each season is different, and a certain percentage of those populations is better adapted to the situation. In another season it will be another part of the population. It is perfect for small farmers who use manual labor, but as these varieties have the imperfectness of not all growing and ripening exactly at the same time, they are not good for mechanization.

In addition to their adaptation to climate change, these seeds have another major advantage for small gardeners: they are pollinated by bees, which makes their production way easier than pure varieties. And Bee pollinated seeds can be produced cheaply in large quantities. This will give some variation in plants. Each gardener can become a natural hybridizer and choosing what plants he wants to reproduce. This can result in extremely productive varieties of seeds adapted to local conditions, and not only local microclimate but also local insects and diseases. But this adaptation is habitually not effective to continental conditions, like modern hybrids are. Another major advantage of breeding your seeds is that you can breed varieties that can grow with a minimum of fertilizer. Synthetic hybrids need a lot of fertilizer. And natural seeds make food that taste better.

To help solve the hunger problems in the world we can take the natural seed idea even further. Both for small gardeners, and for making Seedballs for large scale use. Here's the idea: most edible wild plants have a vitamin and mineral and Phytonutrients content enormously greater than all the vegetables sold in stores. This can be vital in the case of the Covid pandemic. Often these edible wild plants are just ancient vegetables that have been used commonly for millennia and returned to a wild or semiwild state. Several of these wilder vegetables are very robust and can easily grow in difficult conditions, such as poor soils or uneven terrain. Many are resistant to drought. They can be grown in places where there is no farming, or between trees. And those wild vegetables are deliciou.

For the launch of my company SeedTheGlobe this spring I had to deal with an unusual difficulty in obtaining seeds. Many of the seeds I needed were no longer available in my country, and in addition there were border problems that prevented some seed companies to ship seeds here. Knowing and being able to harvest seeds of wilder vegetables (Bee pollinated standard vegetables and wilder ones), could prove vital not only in the future, but right now for many people that are in great need for food.

Organic farming could grow exponentially

What interests me the most, and this is the reason why I did all that research on developing tools to make Seedballs, is that I am convinced that the use of edible wilder plants is the future of Biological Farming. With Seedballs you can not only replant trees, but also plant wilder food plants, which are nowadays called “Superfoods” and sold at high prices in health food stores.

Today a third, yes $\frac{1}{3}$ of the global area of Certified Organic land is used to harvest wild food and medicinal plants, and for honey production. As we all know the overexploitation of wild plants very often cause their extinction. But with Seedballs we have a powerful way to multiply them and replant forests at the same time. And it's lowtech, affordable and easy. Did I told you that this is also lots of fun and delicious? Of course we will have to relearn how to use Nature. Planting Seedballs and growing natural seeds can create a large number of jobs in a form of agriculture better suited to our humanity. While reconstructing this magnificent planet.

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