

**Yield data on 'other crops' being raised on permanent raised beds
using SRI principles with mechanization:**
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FarmAll Technology Pvt. Ltd. has been a series of trials/evaluations since 2009, first on irrigated rice following System of Rice Intensification (SRI) principles with almost full mechanization, to reduce labor requirements and economize on water and other inputs. After successful adaptation of SRI principles and practices for rice grown on permanent raised beds, FarmAll has further adapted these techniques and machinery for a succession of other crops such as wheat, onion, carrots and potato. The most interesting results are reported here.

Most of the land used is saline, with pH ranging between 8 and 9.5. Raised bed technology is very suitable for high saline soils. Further, with our system, we can sweeten the soil around the root zone by precision application of a mixture of chemical fertilizer, compost, gypsum, and sulfur. A single application can drop pH by one point, say from 9 to 8 (9 being 10 times more alkaline than 8). The experiments with other crops were conducted in high saline area where pH is >8.5, and water EC is >3.

Onions: Onion is not pH-tolerant and grows best in soil less than 7.5 pH. The trial was conducted on 8.5 pH land. We applied, by machine, 4 bags of gypsum with 1 bag of NPK between the crop rows (9 inch row-to-row distance), placing the material 4 inches below the soil surface. Also, 2 bags of gypsum were mixed with 4 bags of compost (each bag 50 kg) and were applied just under the plant rows.

Depending upon the variety, we can have 80,000 to 120,000 plants per acre. Weight of the bulb can be anywhere between 10 to 400 grams. We achieved 130 g average weight, and total per acre yield was 11,050 kg (184 bags of 60 kg each, a local measure). Four irrigations were given in furrows. Bulbs in the outer rows (nearer to water) were smaller than in inner rows. This was a great achievement.



Carrots:

The traditional system of carrot growing is for farmers to cultivate the soil several times after initial irrigation when the soil is more workable to make a seed bed on a flat surface. Seed is then hand-broadcasted, and later furrows are made across the field at 28 inches distance with a tractor-mounted ridger. The problem with this process is that seed is concentrated on the top of the ridge and the furrows have no plants. Only 20% of the crop is A-grade, and the carrots are in many different shapes and sizes. Harvesting is very difficult due to water saturation in soil compact it and the carrots cannot be pulled by hand. As such, each carrot is dug up using a handgrip hoe. Sorting, grading and washing are done manually. So this is a labor-intensive process, not feasible for larger-scale operations.

We made many specialized machines to reduce the number of tractor passes in the field. These machines included a raised-bed **pneumatic precision seeder** (suitable also for corn, sunflower, soybeans and cotton), and a **raised-bed random seeder** (suitable for wheat and all other small seeds). Both are constructed with fertilizer and compost applicators. Also, both the implements are available with a bed renovator attachment, seen in the pictures.



Bed renovator with precision pneumatic seeder and fertilizer applicator

A requirement is using a **precision seeder** for all crops so as to maintain seed-to-seed distance. It is difficult without first pelleting the seed. A pneumatic seeder gives best results when seeds are rounded in a size 4-8 mm. For this we are working with two companies based in Germany and Belgium to develop a technology for pelleting all kind of seeds for accurate placement. A pilot project is planned to go into operation to pellet wheat and carrot seed in October this year.

In the absence of such a facility, we had no option but to plant carrots with a random seeder. Carrot seed is so small that it is hard for a machine to uniformly distribute 160,000 seeds (weighing 150 g) for 140,000 mature carrots from one acre.



Makes raised beds, apply fertilizer & compost in a band and place seed at random.

We have found a temporary solution, by mixing carrot seed with 20 kg of dried compost and planting this mixture on raised beds. This worked well. We wanted 80% carrots of same size and shape which could only be achieved with a pneumatic seeder, however, we got nearly 50%. Even so, the yield was quite good -- more than three times the conventional result, i.e., 18 tons per acre as against 6 tons.



Potato:

Most of the farmers grow potato from tubers, which is very costly, and most of them are imported from Holland. We decided to develop a technology to grow potato from True Potato Seed (TPS). Seed in a small quantity was imported from India, and a nursery was established with trays. From these, the small young potato plants were then transplanted in an open field into raised beds. Again, we have pioneered in growing potato from TPS on a large scale.

We were able to produce 65 bags of 130 kg each per acre (21.125 t/ha). This is considered zero-generation seed, and it has no viruses or diseases. It was a seed crop, and a commercial crop shall be grown from this seed in the coming season, October. TPS has reduced planting cost by four times.

The innovation was to grow potato on raised beds using SRI/SSCI practices. We could have 30% extra plants, meaning three rows in place of two in the same area while providing the same space to each plant. One furrow was reduced in the process where an extra row of plants was established.



Wheat:

Wheat has also given very encouraging results with these adaptations of SRI concepts and principles. Per acre the yield has been 73 monds (1 mond is 40 kg), i.e., 2.92 tons per acre, or 7.3 t/ha. This is over twice the usual yield of the best farmers in the area. All this was achieved with 70% less inputs on average: less machine hours, man hours, water, and fertilizer use.

In our trials so far, we could not place wheat seeds at a uniform distance in a row as explained above. Without pelletizing the seed and planting with a pneumatic seeder, we cannot achieve accurate plant-to-plant distance. We hope to adopt this practice once we can develop in-house pelleting facility.



New Initiatives

In May, June and July, we promoted raised-bed technology for efficiently growing mungbean crop. The mung planting season clashes with the onset of the monsoon rains, and when the mung crop is planted on a flat surface, most of the plants die or are affected with diseases. Mung is considered as an important part of the diet for the poor. Due to persistent crop failures, the price of mung has increased four-fold in the last three years. Mung has been planted on raised beds at many places this year with very encouraging results, in spite of the extraordinarily heavy rains this season. We expect to have many more crops under the new management system in the autumn season this year.

