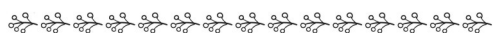




Multi-layer Natural Farming Model with Livestock Integration

Case of Srinivasa Prasad, Sathya Sai District, Andhra Pradesh



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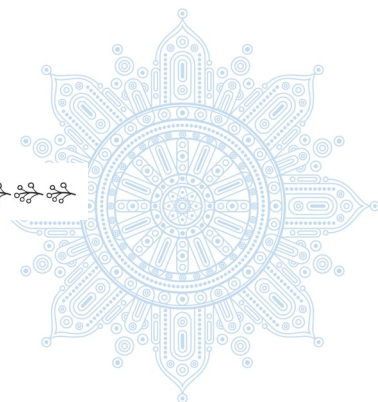
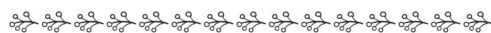
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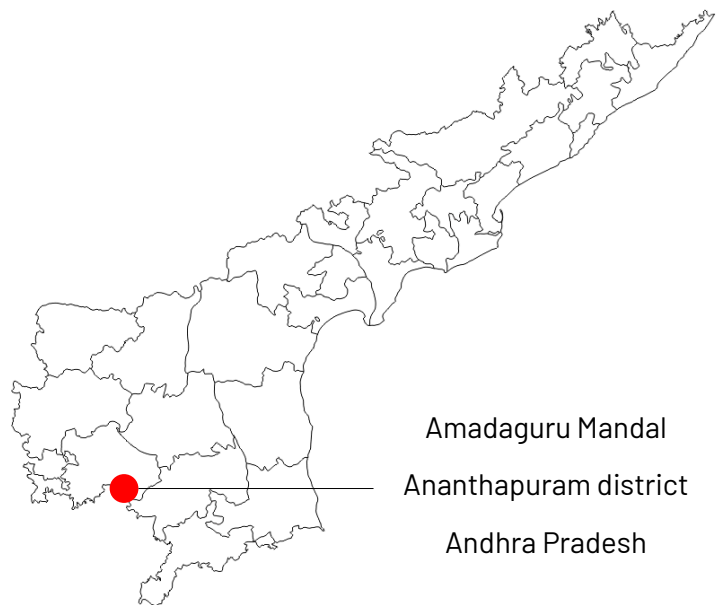
Story so far...

Meet Srinivasa Prasad

Srinivasa Prasad, a 40 years old farmer lives with his parents, wife, and two children in Jawkala Hamlet of Gundawari cluster, Amadaguru Mandal, Satya Sai district (erstwhile Ananthapuram) in Andhra Pradesh. The family has 2.5 acres of agricultural land, a few cattle, and a poultry farm. Their primary source of income is through sale of poultry birds from their breed farm and cow milk.

A few years back, Srinivasa used to cultivate tomatoes and fodder on 1.2 acres of his farmland applying chemical fertilizers and pesticides for better yield and had borewells for irrigation. Additionally, he was using plastic mulch to protect the soil and tomatoes from harsh sunlight. However, in 2019, his borewell dried up and he had to borrow water from neighbors to irrigate the farmland. A depleting groundwater table made irrigation with borrowed water became difficult over time and he had to stop cultivating tomatoes. Cultivation of fodder also came to a pause. As a result, there was fodder shortages to feed the livestock.

The water crisis in the region has forced farmers to dig deeper in order to fetch groundwater for irrigation, some of the borewells are as deep as 1000 ft. Farmers in the region are rapidly leaving farming and migrating to nearby cities for work.



“I dug 9 bores in 9 places and couldn't find any water. I was hopeless. My borewell had dried and would only discharge 1/2 inch of water which was not sufficient to grow fodder for the livestock.

Also, my poultry business suffered extensively due to disease and predation. After facing a huge loss in the business I closed the poultry farm. I was on the verge of selling livestock too.”

What is An Integrated and Intensive Natural Farm



The Intensive & Integrated Natural Farm model has evolved over the last few years. Building on the experiences of *Rythu Sadhikara Samstha* (RySS) as part of the Andhra Pradesh Community Managed Natural Farming (APCNF) program, the present model combines the 5-layer model of Natural Farming with multi-tier tree-crop integrated systems, desi-backyard poultry breed farms, fodder production, and the Maa Thota/ Wadi programs. This model has been standardized in recent years by the WASSAN Team in Kadiri (Sathya Sai District) for the drylands.

The Intensive multi-layer natural farm is a combination of trees and crop cultivation in the same piece of land, integrated with desi-poultry breed farm & livestock. The model is developed for 40 cents of land, with fence around the boundary with green mesh to prevent predation by wild animals. Additionally, a large number of multi-purpose trees are also integrated to develop live fencing over a period of time. Four ram lambs and two indigenous cows are integrated into the model, these share a common shelter with the desi-poultry birds. Fruit trees, fodder, and other crops are planted on the farm. The farm required limited but assured irrigation. No chemical fertilizers and pesticides are used

on the farm! Livestock integration especially poultry helps in natural pest management services. In the Rayalseema region, the following aspects have been included while designing the farm:

Critical Design Elements

■ **Diversification (Crops, fodder & trees):** Multi-tier plantations with several varieties of fruit trees like mango, guava, and pomegranate; and fodder trees; fodder plantation (*Sesbania*) in the lower tier and vegetable cultivation. Besides the fruits etc., provide good forage for desi poultry.

■ **Nutrient Recycling:** Livestock integration in the farm is designed to establish the nutrient recycling. They provide manure for the farm and meat, milk for the family and for sale. The farm produces fodder for small and large ruminants and foraging for desi-poultry.

■ **Targeting Diversified Living Incomes:** The farm provides diverse, regular and high incomes from the half acre with little paid-out costs.

■ **Following Natural Farming methods**

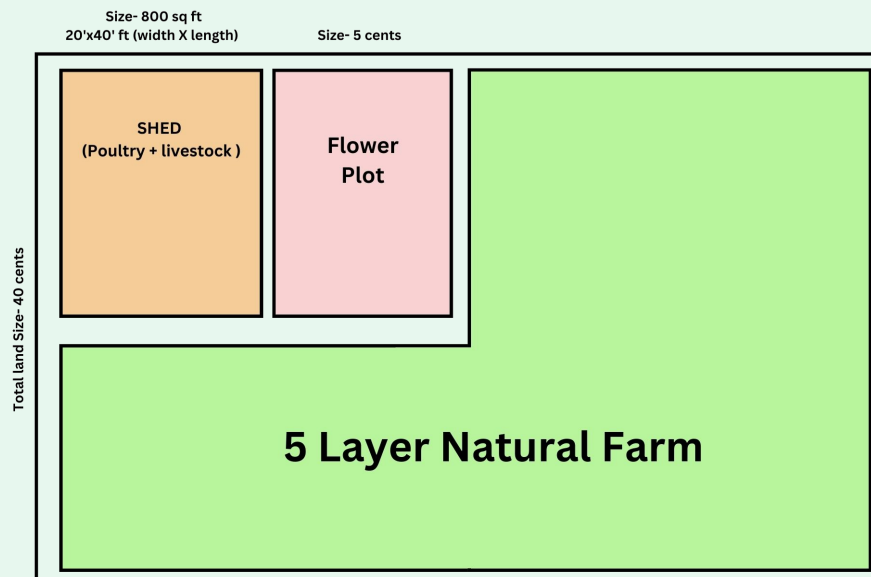


In September 2020, when a team member from WASSAN met Srinivasa and visited his farm. They observed that half (around 1.3 acres) of the farmland was not cultivated due to the non-availability of irrigation. He was introduced to the above model which promised increased land productivity and income. He agreed to try out the model on a half acre of land and thus began his journey.



Steps taken

The following action steps were taken to get work started...



Pre-Requisite:

A minimum of half acre area is required to develop an Integrated & Intensive Natural Farm. It should have access to water, though minimal, in the initial two years.

■ *Srinivasa's Farm Design*

1 Discussion with Farmers

Multiple rounds of meetings with the farmers. The existing farming practices, native trees, and crops, and farmers' preferences are noted. A crop calendar for the region is made based on the discussion.

2 Designing of the farm

The multi-layer farm is designed after considering farmers' preferences and some thumb rules - layers based on plant height, spacing & growth pattern. The design of the farm is built on farmers' knowledge and their family needs and local conditions.

3 Plants, crops, and tree selection

The list is prepared after rounds of discussion with local farmers. A list of native plants, crops & trees is prepared that fits into the multi-tier system & meets multi-functionality.

4 Training

Farmers are trained on desi-poultry management and livestock management practices and on general management of the farm.

Srinivasa's Intensive Multi-layer Natural Farm



The field team engaged with Srinivas and designed his farm (*refer to box*). The farm now has more than 76 native varieties of fruit and fodder trees, and fodder crops such as *super napier*. It has more than 500 sesbania, mulberry trees and creeper vegetables growing along the fence.

■ **First Layer:** Also known as the canopy layer, fruit trees with larger canopy are planted with a gap of 36ft. Once developed fully, the canopy formed provides sufficient shade for poultry birds. (refer *picture below*).

■ **Second Layer:** This is the understory layer, short fruit trees are integrated at a spacing of 18ft from the first layer fruit trees. The short fruit trees are integrated and planted in-between tall fruit trees. For example- between mango and Jamun, a papaya tree is planted. A total of 24 fruit trees are planted on the farm.

■ **Third Layer** This layer consists of perennial trees like drumstick at 9 ft distance and perennial redgram at 4.5 ft distance. A total of 36 trees & plants are planted in this layer.

■ **Fourth and Fifth Layer:** Both these layers consist of approx. 4500 plants (approx.) of *super napier* at 2 ft. distance. and approx. 9000 (approx.) and *Stylo hamata*.



■ **Vegetables:** Srinivas also grows leafy vegetables & creepers like *Kakra* (bitter gourd), *Beera* (Ridge ground) and other seasonal vegetables on 10 cents land. The vegetables are presently used for consumption in the family, some are also consumed by the poultry birds.

■ **Flowers:** Due to the high demand for flowers in the region, Srinivasa has dedicated 0.5 cents of his farm to flower cultivation. He has planted roses and marigolds on the farm at a spacing of 2 ft.

■ **Fencing:** Mulberry and *Sesbania* are fast-growing trees that generate substantial fodder biomass on the farm. Both are planted at a distance of 3 ft each.

The mixed-crop farm system approach takes advantage of the symbiotic plant–poultry–livestock relationship in nutrient recycling minimizing the need for external inputs. Additionally, this design ensures round-the-year soil cover (green / dry mulching) and good turnover of biomass into soil—helping in carbon sequestration.

About 200 kg of *Dhrava-jeevamritam* and *Ghana-jeevamrutam* on the farm once a month. The majority of the ingredients for these farm inputs are generated on the farm itself. Integration of trees in the farm provides shade and shelter for livestock. It protects the farm from heavy wind.

Mr. Uthappa from WASSAN pointed out that **“the presence of trees in the farm reduces the rate of evaporation and therefore maintains moisture for a longer period. The model creates circular nutrient flow between agriculture-horticulture- poultry and livestock thus reducing the need for external inputs and increasing complementarities in production.”** He further adds that “integrated and intensive Natural Farms such as Srinivas’ can generate decent farm incomes for smallholder farmers from as less as half- acre farm land.”



“ I am able to save water through this model, and provide fodder to my cows”

Says Srinivasa.

Srinivasa also practices the following packages of practices in his multi-layer natural farm.

① PRUNING

He prunes fast-growing trees every three months.

② USE OF ORGANIC MANURE

He applies *Ghana Jeevamrutham* and *Drava Jeevamrutham* on his farm once in a month. These are prepared by him on his farm.

③ MULCHING

Srinivasa uses trunks of sesbania, and dry leaves collected from the farm as mulch.



■ In the initial period, though, the farm is fenced and secured from foraging birds.

“Vegetables generate more income for me and that is why I am planning to integrate and cultivate more creeper varieties. The vegetable yield is good on the multi-layer farm. I do not need to mulch the farm, the poultry birds do that for me. Mostly I mulch the flower bed. Also, the main farm does not require mulching as the foraging desi-poultry birds does the work of weeding.”

Says Srinivasa.



①

LAYER - 1

Mango + Jamun - 36 ft distance—total 16 trees in half acre

②

LAYER - 2

Lemon + Guava + Pomegranate - 18 ft distance - total 18 trees

③

LAYER - 3

Drumsticks + Perennial Pigeon Pea - 9ft distance - total 36 trees

④

LAYER - 4 & 5

Approximately 4500 **Super Napier's** in 2 feet distance and
Approximately 9000 **Stylo hamata** at 1 ft distance respectively.

Desi Backyard Poultry Breed Farm



In his earlier experience, Srinivasa had witnessed huge losses in poultry with broilers. One infected bird leads to the entire flock getting wiped out in a short period of time. Sometimes predators would hunt down majority of the birds. In his present multi-layer farm, Srinivasa has kept five different varieties locally sourced desi-poultry birds on the farm and has fenced the farm with green mesh to protect birds from predators. He maintains 50 hens and 10 cocks on the breed farm. The shed dimensions are 20 ft * 40 ft. The desi-poultry shed is built on about 35 cents of land. Biological fencing demarcates the scavenging areas for the free-ranging of birds. Sesbania trees, grass fodder, and mulberry trees along the fencing serve to increase the resource base for scavenging.

He provides the birds with supplementary feed- a mix of broken rice, maize, and bajra. On average, the flock eats up to 1 kg of supplementary feed in a month. Sometimes the birds are fed with boiled sesbania leaves. According to Srinivasa, 25% of the feed is sourced from his own farm. He says " poultry waste is nitrogen-rich and provides nutrition to the soil". There is also a small hatching place inside the shed. The average production of chicks is a minimum of 20/per year per hen; egg count comes to about 24 in a year. At any given time, the farm has 80 birds which includes growers and chicks. Average mortality in adult birds is 8%, whereas in the case of chicks, it is higher- 25%.





■ PRE-PAID VACCINATION SERVICE:

Srinivasa and other Desi poultry farmers in the village have formed a Common Interest Group. All members pay money upfront every month to avail pre-paid vaccination services. The vaccination charge is Rs. 2 per chick.

■ TRAINING TO LOCALS AS VACCINATORS:

There are two trained local para-vets, trained by WASSAN. They are trained in healthcare management of poultry and livestock to allow better access to livestock health services locally.

■ AZOLLA PITS AND TERMITE POTS:

Azolla pits are constructed and azolla is grown within the farm to feed poultry birds. A few termite pots are kept to allow flies and other insects to grow inside.

■ COW URINE FOR POULTRY:

The farm has provision for collecting cow urine; which is used for preparing natural farming inputs.



Integrated Livestock (Small and Large Ruminants)



Srinivasa has five ram-lambs and two cows (*one desi-cow and one jersey*). He buys 4-5 ram lambs in a year, which he sells after fattening for 3-4 months. He purchased five ram lambs in March last year and sold them in June 2022. Small & large ruminants on the farm share shelter with poultry birds. Fodder grown on the farm provides six months of feed for small & large ruminants. Remaining fodder demand, was fulfilled from his uncle's farm and open grazing.

For large ruminant feed, he provides a mixture of groundnut husk, horse gram husk, and paddy straw. The Jersey cow needs approxi-

mately 80kgs of feed per day, 30 kgs green fodder and 50kgs dry fodder. The desi cow is mostly taken to fields for open grazing while the farm provides for green fodder.

Horsegram and groundnut husk, sesbania and mulberry leaves are the usual feed provided to small ruminants on the farm. Most of the feed is grown on the farm. Around 50 sesbania trees (about 25 cents land area) generate enough fodder for feeding 4 ram lambs.

Srinivasa collects cow dung and urine to make organic manure supplement for the farm. Ram lambs love eating mulberry on the farm.





“Being able to live in the village and work on the farm while seeing the poultry forage around makes me happy & relaxed. I think a lot of my success is due to the integration of farming with birds and livestock. Other farmers should understand that the situation completely depends on them. They have the option to transition to this model to make farming profitable. This model saves water. The amount of water I was using to grow tomatoes, is now being used to grow more than 10 different fruit trees, fodder, plants, and vegetables”-

says Srinivasa.

Initial Investment



Initial investment in the farm was done in September - December, 2020. Majority of the investment is one-time establishment of poultry shed, farm fencing and saplings. Srinivasa purchased approximately 45 tree saplings from a local nursery also sourced a few fruits saplings from his neighbors. Developing the farm needs good initial investment. The investment has a quick pay back period.

DETAILS	PROJECT SUPPORT (Rs.)	FARMER CONTRIBUTION (Rs.)	TOTAL INVESTMENT (Rs.)
■ Trees Sapling <i>(Mango, Jamun, Guava, Lemon, Pomegranate)</i>	5,940	2,650	8,590
■ Shed <i>(Poultry Shed Construction)</i>	30,515	22,500	53,015
■ Fencing <i>(Wooden Poles, green mesh)</i>	9,500	28,500	38,000
■ Livestock Support <i>(Birds Purchase, egg laying boxes, feeders, drinkers)</i>	27,436	29,000	56,436
■ Livestock Purchase <i>(Ram Lambs, Desi cows)</i>			
■ Fodder + Vegetable Seed Purchase <i>(Super Napier, Avisa Seeds, Mulberry, Creeper Vegetables)</i>	2,550	5,500	8,050
■ Irrigation Facility <i>(Drip Pipes)</i>	5,000	2,500	7,500
TOTAL	80,914	90,650	171,591



Financial Outlook

The different elements integrated into the farm ensure that income starts flowing from the 6th month onwards on a regular basis. The sources of income are:

- (1) Sale of birds, and eggs, (2) Sale of milk, (3) Sale of ram lambs,
- (4) Vegetable & flower sales, (5) Annual fruit trees, (6) Perennial fruit trees,
- (7) Seed sales, (8) Bio-inputs sales, and so on.

Every month Srinivas takes 1 or 2 chickens from the farm for his family's consumption. They also consumes 1 - 2 liters of milk per day produced by desi-cows besides consuming naturally grown vegetables etc.

In 2021, Srinivasa sold produce worth Rs. 1.56 lacs, spent Rs. 55000 (approx.), and earned a net profit of Rs. 96000.

In 2022, the farm produced 35 kgs of sesbania seeds, which Srinivasa sold in the market at Rs. 600 per kg. In the second year, Srinivas integrated creeper vegetables in the fencing beans and ridge gourd, which he is cultivating for house consumption. He is able to produce 20-45 kg of vegetables from the fencing area alone. He plans to intensify vegetable plantation in the near future. Srinivas bought 30 rose plant for Rs. 30/sapling (Rs. 900). He hired labor to harvest rose flowers and generated Rs. 16,500 profit in 2022. The flower beds are separated and fenced properly so that desi-poultry can not enter or disturb them. He spent approximately twenty thousand rupees and generated approx. 1,37,000/- net profit in the year 2022. Srinivas is hoping to get fruit yield from lemon, guava, and mulberry trees from 2023 onwards. He plans to add more trees to the farm in the coming time.



S. No	Elements	Description	Year 1			Year 2		
			Revenue from sales (Rs.)	Operational Expenditure (Rs.)	Net income (Rs)	Revenue from sales (Rs.)	Operational Expenditure (Rs.)	Net income (Rs)
1	Desi-Poultry	Sale of birds and eggs, expenses on feed and	21,950	1,879	20,071	32,000	4,100	27,900
2	Small Ruminants (ram-lambs)	Sale of lambs after fattening, expenses incurred to purchase	38,000	30,000	8,000	0	0	0
3	Large ruminants (cows)	Sale of milk, expenses on fodder and	91,225	22,670	68,555	86,850	12,160	74,690
4	Multi-layer farm (including all layers, vegetables and flowers)	Sale of flowers and sesbania seed (2nd year), expenses on seed, labour, saplings etc.	0	0	0	37,500	2,900	34,600
Total (Rs.)			151,175	54,549	96,626	156,350	19,160	137,190





Conclusion

Intensive & integrated natural farming is a pathway for smallholder farmers to earn high incomes from very small holdings; it has shown a pathway for economic growth with ecological intensification. Apart from providing better living income with high levels of resilience, the models contribute substantially towards mitigating climate change; especially in rainfed landscapes. The case study of Srinivas from Jawakala village in Sri Satya Sai District of Andhra Pradesh is one of the several such cases of natural farming emerging from the APCNF program facilitated by WASSAN.

Intensive natural farms can potentially sequester carbon and thus can contribute to mitigating climate change. The multi-layer farms with tree canopy covering a large part of the land, 2 to 3 layers of multiple crops including fodder and vegetables

The model consists of a multi-tier cropping system in line with the five-layer model but with the last two tiers replaced with field crops and fodder. The farm has a foraging desi-poultry as one of the key components, sheep and milch cows. The land is covered with multi-tier canopy, thus maintaining a cooler micro-climate within. Trees, crops, vegetable production, desi-poultry, and livestock components are interdependent with nutrient flow from one system to another. Foraging desi-poultry consuming insects as feed minimizes the need for pest management. These interconnections minimize the need for external inputs and enhance land productivity.

High organic matter, cover crops, tree canopy, and mulch helps in harvesting a larger part of

rainfall and retain soil moisture for long. These farms use minimal water through drip irrigation to supplement soil moisture; the area receives just about 600mm of rainfall.

Adopting natural farming practices such as minimal tillage ensures the soil is not disturbed much, combined with addition of biomass into the soils it contributes towards sequestering carbon in the soil. Also, the model encourages the use of local seed varieties making the farm rich in biodiversity.

The intensive & livestock integrated natural farming model, although capital intensive in the initial phase- Rs 1,71,591 per half an acre (in Srinivas' case), the return on investment is high and pays back within 3 years. The farm produces a diverse and significantly high source of income per half-acre farm - about Rs. 1 lakh per annum; this far exceeds the net income earned from migration. Farmers can generate income by selling vegetables, flowers, seeds, fruits, poultry, ram lambs, and cow milk. It reduces farmers' risk of relying on one crop. As the year progresses, the input costs get subsidized, enhancing net returns. The diversity of income portfolio brings in high levels of resilience to the livelihoods of the family.


Multi-layer systems with livestock integration optimize the benefits from the biological interactions created when trees, crops, and livestock are combined. It produces food for families, poultry & livestock ensuring nutritional security, sustaining livelihoods, alleviating poverty, and promoting productive, resilient agricultural environments with a high level of ecosystem services. ■



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WASSAN Case Study | January 2023

A photograph of a brown and black rooster standing in a lush green field. The rooster is in the foreground, facing left. The field is filled with tall, green grass and other vegetation. In the background, there are several trees with light-colored bark. The overall scene is a natural, rural setting.

The Intensive livestock integrated farm model is spreading in the APCNF program supported by Azim Premji Foundation. WASSAN & RAINMATTER FOUNDATION are exploring ways of establishing support systems for spreading this agroecological farming practice across diverse agro-ecologies in the country. The case example was taken up in this context.