



## Racy Nature (Land and Water)-SIMM (System of Intensification of Minor Millets) Combo Endowed with Eco-Zero Weeding Towards Quantum Mechanics Based Agriculture for Arid and Semi-arid Climatic Zones

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### Abstract

It will be an ideal and feasible endeavour to develop a system of intensification of minor millets (SIMM) with reasonably high yields under severity of vagaries of rains in arid and semi-arid regions. This system should alleviate food and starvation that will be insurance for getting relief from famine like situations. The objective of this study was to devise a panacea Agri-technology named RACY-SRI COMBO for intensification of minor millet as 4G technology for upland agriculture where paddy cannot be cultivated. The present study aimed at devising land and water management practices to produce crops and composition of practice to conduct secondary natural resources towards crop growth. Application of the scientific facts and principle of irrotational mechanics make it as quantum agriculture. The new yield plateaus were derived and other food commodities enabled. Thus, although coarse grain, but nutritionally rich minor millet grains can be processed to produce food of liking, palatable for the people. The RACY NATURE-SIMM COMBO will enable produce tremendous volume of grains that will enable making available processed nutrient rich foods for large population. This innovative technology will alleviate food scarcity during unprecedented years of drought, hence it will create global livelihood as well as insurance against starvations during famines.

**Keywords:** Arid and Semi-Arid Regions; Climate Change Food and Nutritional Security Human Needs; Nature Agriculture; Minor Millets and SRI

### Introduction

Human's immediate basic needs get prioritized as clean and fresh air, potable water, food, sanitation, clothes, housing and safety security. The other requirements are social and egoistic needs, self-satisfaction, patriotism, sacrifices of one's means for other welfares. Towards fulfillment of these varied needs, recent researches had been attempting to address these basic necessities and many manifestations based on scientific advancements. This researcher endeavored to combine knowledge of plant science, soil science, chemistry, agronomy, inter-cropping, mechanization, crop processing, mechanical engineering, environmental engineering, sociology, food science and nutrition, energy management, land and water management and manoeuvre of water and environment interactions. In this study a new agriculture named Racy Nature (smart, alive and enthusiastic) agriculture was developed with land and water smart management practices [1,2], which is applicable for all

soils, ecosystems, crops, cropping practices and both rainfed and irrigated agriculture as sun technology against the land and water practices which had been mere white spots [3]. Almost during the same time in Madagascar, an African island, a plant physiological innovative technology was developed, was named as System of Rice Intensification (SRI). These two practices were addressed as generation II (2G) practices. While Racy nature agriculture has been a recent one, it is gaining popularity for adoption and application, the SRI has become very popular in the South India for rice cultivation. It may be mentioned that rice is staple food for almost 50% global population, largely concentrating in Asia and South East Asia. There has been alarming demand for enhancing production of rice to fulfill food need of rising population [4]. There have been environmental issues tagged with paddy production as release of green-house gases (GHGs) viz. methane, nitrous oxide and carbon dioxides (in order of severity a decade ago) hence levy of pressure

from the USA for reduction of cultivation of paddy. The constraints of climate aberrations, high water demand and development of poor quality water in paddy production compelled to develop refinements to increase productivity and protection of environment. The study by Yadav [5] was a landmark in cultivation practice for zero methane emission from the paddy fields. Yadav [6] combined this land and water management practice and the SRI plant physiological practice and produced a new generation III (3G) technology named as Racy Nature-SRI Combo as 3G technology for paddy production. The land form feature (Figure 1) and the inherent advantages will be dealt with in the following sub-sections.

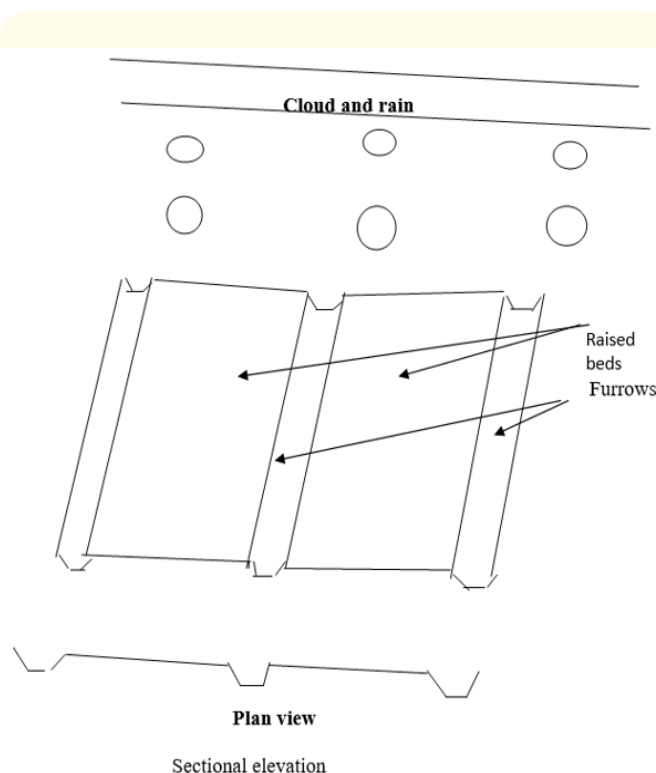
In arid and semi-arid areas, the climatic aberration has been still getting more severe than that arising in paddy production. The food situation for the remaining 50% of global population is not so less alarming. Hence, it called for some innovative development in agriculture for arid and semi-arid areas of the world. An effort on line with Racy nature and SRI Combo can be a right line of action to alleviate the grim situation. There exist many minor millet crops in India such finger millet (*Eleusine corcana* (L) Gaertn.) (Ragi/Mandua) and barn yard millet etc. in India and a similar crop in addition to the finger millet in Ethiopia, Central East Africa, named as Teff (*Eragrostis teff*) which grow well in in highlands. Intensification of cultivation of these minor millets, which keep plant height at par with the paddy crop, can be an interesting and full of curiosity towards finding solution for arid and semi-arid situations. The objective of the present study was to develop Racy Nature-Simm Combo with addition of recent advancements made by this scientist on nitrogen cycle management [2] and sulphur cycle management [7] viz practices of zero weeding agriculture and sulphur management practice endowment for arid land/rainfed as a quantum mechanics agriculture to become a Sun technology of generation IV (4G) for arid and semi-arid agriculture. It may be mentioned that weeding is severe problem in many conservation practices viz. zero and minimum tillage and in dry land/rainfed agriculture, due to occurrence of continuous rains at times as well as during shortage moisture in dry fields restricting weeding operations.

## Materials and Methods

### Racy nature Agricultural Technology

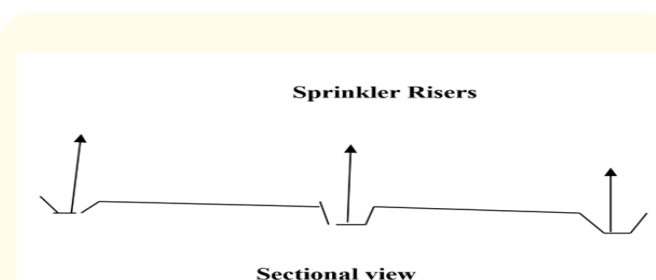
A knowledge intensive green technology for the time sequence and convergence based new live, smart and enthusiastic (Racy) named as, Racy Nature Agriculture (land form Figure 1a, 1b) was innovated to alleviate the drudgery of the adverse factors in present day agriculture and convene sustainable global food security and protect environment. The detailed description about the developments and the successful outcome of green technology and its efficacy are available in various studies [2,7,8].

The racy nature agriculture focuses and meets world over challenge in the use of natural and fixed resources for agriculture and environment conservation, which have not been found in the existing scientific ventures.



**Figure 1a:** Universally applicable land form of raised bed and furrow under cloud and rain.

This land form is compensating during flood and drought hydrologic conditions.



**Figure 1b:** Universally applicable land form of raised bed and furrow under sprinkler irrigation. The sprinkler irrigation aerates water to make it green. Furrow irrigation is over flooded during tillering, ear head and grain filling stages of crops.

## The SRI

The system of rice intensification (SRI), developed in Madagascar by a Church priest Fr Henry, a social reformer, is basically a plant physiological innovation-based technology. Young seedlings of 10 - 12 days old are transplanted in high density (22 cm x 22 cm grid), while the water submergence, fertilizers, manures and some agronomical practices are flexibly at par with the other earlier known practices. Cultivation is carried out where no prolonged flooding is maintained so anaerobic decomposition is eliminated from the system [http://]. The SRI method can be said on the basis of its cultivation after planting to fulfill requirement for the operation of the sulphur cycle. System uses compost in nursery preparation, which releases methane and includes no simple way of supplementing sulphur, an important plant supporting nutrient. Application of aerobically decomposed compost (NADEP in India) will make it a true scientific fact-based method of universal application for rice cultivation for bringing sustainable agriculture and protection of environment [7]. The extensive researches are being conducted on SRI in the world where in by now more than 300 research articles have been published. Thus, need and scope is emerging for conducting scientific evaluation of these researches to know the scientific sufficiency so as to enable further innovation in paddy production. So far, the results that came to notice during the present study SRI have shown 10 - 15% increase in the yield of paddy over that of conventional method of cultivation. Further, yield potential is to be contrasted with that of flooded rice cultivation in low land condition.

Water regime has been researched upon and so was the issue of methane release. The yields have increased due to prolonged growing period and high density/exhaustive tillering. This is not a complete green technology. Study [9] made suitable recommendations to improve module to make the SRI a green technology of paddy cultivation.

## RACY-SRI COMBO Agriculture technology

The study culminated in innovative RACY (Land and Water)-SRI (Plant physiological innovation) COMBO technology for natural and scientifically induced secondary resources use in agriculture. In general, earlier researches had focused practices in isolations and their interactive and long-term interactions were not adequately visualized. The convergence and congregation of the best form and doses are constituted in innovative green live, smart and enthusiastic (Racy) nature agriculture and resources management. The SRI superimposed on racy nature brings effect of plant physiology in productivity. There will be complementary effect of racy nature (land and water) and nutrient and SRI the crop physiology, hence benefit for yield will get magnified.

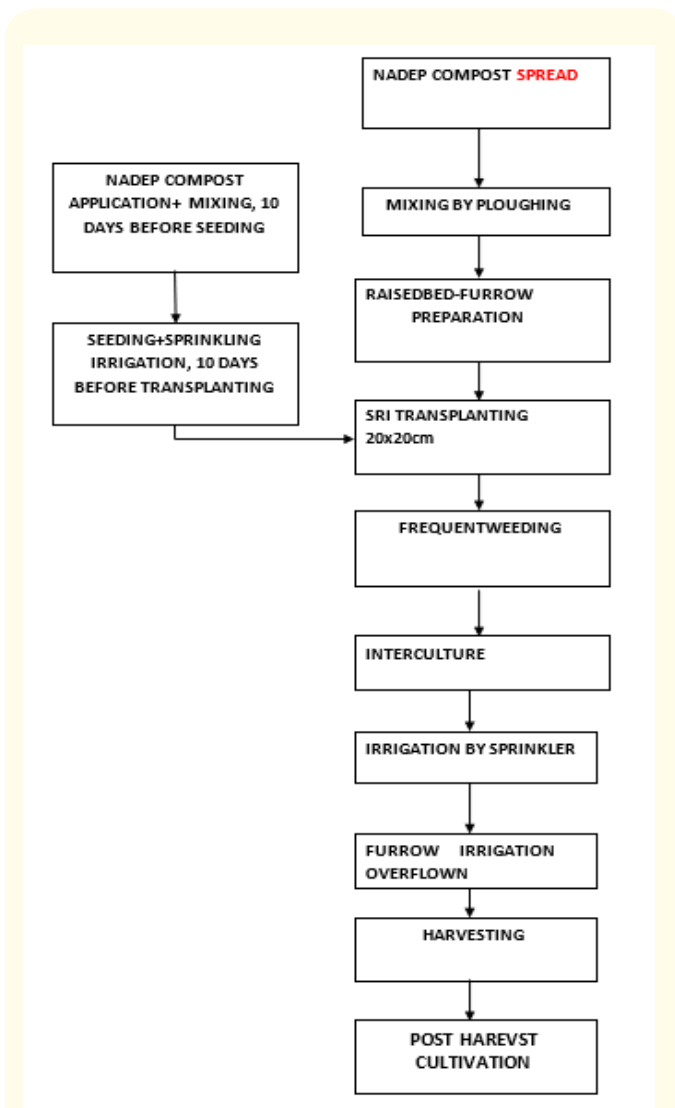
The component practices are well known and their composite validation was drawn from the experiences and data available for individual practices. The composite validation requirement is convincingly made acceptable to merit its initiative for productive agriculture. The pilot field demonstrations will help generate, in short time of applications, make the Racy resources management highly acceptable, adoptable and come in prevalence. The SRI in this regard has already acquired the place. The RACY -SRI COMBO [6] brings in addition to increase in yield, conserves natural renewable resources, non-conventional and fixed resource the land for posterity. The research and development on land and water had already culminated in a Sun technology, which enlightens everywhere and for all time [1,2].

The racy nature a new knowledge intensive technology research convergence on water and environment interactions super imposed with SRI to constitute the RACY NATURE -SRI COMBO is universally applicable for all Agro-ecosystem, soils, crops, for rainfed as well as irrigated agriculture for production of paddy. It links people, agriculture and environment in paddy production. It identifies and fulfils global challenge for charter of natural renewable primary and secondary non-conventional and fixed resources use for agriculture for food security with environment protection. The Racy natural resources management enhances nutrient, moisture and other resources use efficiency of the aforesaid resources. It surpasses and overtakes all previous practices of natural resources management for agriculture and environment protection for paddy production. It will require new tools and machineries for implementation.

## The Minor millets viz Finger millet

In India there are several minor millets namely finger millet (ragi, Madua), Barn yard millet (fox tail millet) and Teff in Ethiopia [10]. The minor millets cultivated in decades of 1960 and 70 have been over taken by other rainy season crops, which have eating preference of the public. However, the climatic aberrations have been making cultivation of rainfed cultivation of millets such as pearl millet and sorghum difficult. The cultivation status of the finger millets is displayed in table 1 and 2.

The minor millets can be grown with suitable land and water management practice viz RACY Nature. Agriculture. The components of conservation practices are uniquely innovated which are different from those recommended in the Status book [11].



**Figure 2:** Flow chart of sequential operations of RACY NATURE- SRI COMBO (3G) rice Production Technology.

The flow chart is equally applicable for RACY-SIMM in the present study.

### Method

With these backgrounds about the land and water conservation technology, SRI and the finger millet, it seems feasible to develop the RACY SIMM on the pattern of the RACY\_SRI combo. However, the yield potential of the finger millet is low but at the same time quantity of consumption of the food prepared from the finger millet is also low. Considering the biological potential of the finger millet possible enhancement in yields are drawn parallel to the RACY SRI COMBO. Based on the yield enhancement factor the enhancement in yield of grain are made for different state. The benefits of the zero weeding, saving in the cost of weeding, nutrient buildup in soil are the additional benefits.

The intra row and inter row cropping are devised to enhance the land equivalent ratio. Thus, yield advantages are drawn.

### Innovation in Crop production Technology

- **Enforcement of manure and fertilization**

The variable soil conditions demand different doses of manures and fertilizers viz N, P, K, etc. Earlier studies have established that application of organic manure to supplement the 25% of N requirement by organic manure especially aerobically decomposed compost is the best option to get maximum yield of cereals, oilseed and pulses. Accordingly required operations are charted out for the manure and fertilizer for growing of finger millet or any other millet. This guideline for manure and fertilizer serves as fundamental principle.

- **Enforcement of Nitrogen cycle management for intra and inter cropping**

The best-known practice on the finger millet (status Note book) indicate strip cropping of the finger millet and suitable crop of green gram black/gram or soybean, which bring change in the land equivalent ratio (LER) that reflects economic gain. However, this is not the enforcement for nitrogen cycle in as envisaged in the RACY NATURE-SRI COMBO or to say in the present study RACY-SIMM. The innovative quantum mechanics based intra row and intercropping have been developed based on authors earlier study [12]. Methods are devised to create functioning of the Nitrogen cycle during the crop growth period by creating suitable intra row and inter cropping [13].

- **Enforcement of Sulphur cycle**

It is established fact that nutrient and water use efficiency increase when sulphur (S) cycle is enforced to function in the nitrogen cycle enforced agriculture. Innovative method is suitable devised to establish the functioning of S cycle in agriculture, not by application of S containing fertilization but, creating green chemistry in the finger millet production system.

- **Enforcement of S cycle of eco-agriculture for eco zero weeding**

So far known method of making agriculture free of weeds to save from crop yield loss weeding are carried out twice and thrice in the standing crop, which become costly and at times it cannot be performed due to occurrence of continuous rains. The innovative technology of the eco-zero weeding agriculture has been developed and again fixed by the quantum mechanics.

- **Enforcement of Oxygen cycle**

The bed configuration is devised to create all time circulation of sufficient oxygen in the soil to keep system smart, alive and enthusiastic for which the term RACY was adopted.

- **Enforcement of carbon cycle**

The creation of sun light is not possible by artificial means. However, innovative method is mooted which can create green leaf to promote photosynthesis, a most desirable component of green chemistry to produce yield of crop.

Enforcement of bio inactivation of heavy metals, toxic gases and carbon compounds etc.

In the proposed land formation of raised bed and furrow amendment for bio deactivation by bio charcoal is made. This will maintain carbon balance in the soil and adsorb toxic gases and adsorb toxic salts.

- **Enforcement of sufficiency of method of precision planting**

As such no specific research information exists in the Status

note book for sowing method that can be considered fool proof for stand establishment of minor millets. There can be two methods viz by direct seeding or by raising nursery and transplanting. There have been several studies on the age of seedlings of paddy for transplanting the SRI (Singh., *et al.* 2010). Such experiments need to be conducted for finger millet. Therefore, both the options are to be kept in the cultivation technology for finger millet.

- **Enforcement of bed preparation by feasible and low-cost mechanisation**

Mechanization plays very decisive role in agriculture to create condition for residue management, burying in soil and bed configuration. Innovative green mechanization is devised. These bands of mechanization is not in the practice as a strict practice to eliminate release of GHGs. Enforcement of S cycle will create sulphate, eliminate residue burning, reduce energy input and reduce cost of cultivation.

State	Area		Production	Yield
	Season	Area (1000 ha)	Production in (1000Tonnes)	Productivity, (kg/ha)
Andhra Pradesh	Kharif	46.8(3.6)	52.8(2.6)	1128
Bihar	Kharif	10.6(0.8)	8.6(0.4)	811
Chhattisgarh	Kharif	8.5(0.7)	2.3(0.1)	269
Gujarat	Kharif	18.2(1.4)	15.2(0.7)	835
Jharkhand	Kharif	11.3(0.9)	6.5(0.3)	577
Karnataka	All seasons	781.4(60.1)	1412.6 (69.2)	1808
Maharashtra	Kharif	124.8(9.6)	122.6(6.0)	982
Orissa	Kharif	67.7(4.8)	40.7(2.0)	648
Tamilnadu	Kharif	84.9(6.5)	180.9(8.9)	2130
Uttarakhand	Kharif	129.6(10.0)	175.9(8.6)	1357
West Bengal	Kharif	11.5(0.9)	13.1(0.6)	1138
Others	Kharif	9.4(0.7)	9.58(0.5)	1011
All India	Kharif	1299.7	2040.7	1570

**Table 1:** Statistical details of production of finger millet in India.

NB: Figures in the parenthesis indicate % share to all India.

Source: Status Book, 2014. Directorate of Economics and statistics, DAC.GOI,

S. No	Finger millet growing states	Area spread in blocks/sowing seasons rainy season/Winter season/summer season	
1	Andhra Pradesh	6	
2	Bihar	1	
3	Gujarat	2	
4	Jharkhand	1	
5	Karnataka	14/3/3	All three seasons in karnatka
6	Maharashtra	7	
7	Orissa	9	
8	Tamilnadu	6	
9	Uttarakhand	9	
10	West Bengal	1	
	Total	62	

**Table 2:** Number of districts with an average of 2000 ha in descending order. Data based on Status Note GOI.

### Impact evaluation indices

The RACY-SRI COMBO [6] has effectively established performance evaluating indices. These indices will be again evaluated for the RACY-SIMM.

### Results

#### Yield responses

The components of the RACY -SRI COMBO for crops of high yield potential and that for Finger millet or any other small millets have been derived in table 3. The Racy-Simm enable development

S. NO	RACY_SRI COMBO	Possible increase, %	RACY SIMM COMBO agriculture practice component	Possible increase, %
1	Aerobically decomposed manure, application	15	Aerobically decomposed manure, application	10
2	Ploughing	5	Ploughing	3
3	Formation of raised bed furrow system	10	Formation of raised bed furrow system	6
4	Precision planting of 10 days dender seedlings as followed in SRI at 20 x 20 cm.	15	Precision planting of 30 days tender seedlings as followed in SMI at 30 x 10cm	10
5	Maintenance of optimum plant density	10	Maintenance of optimum plant density	6
6	Sprinkler irrigation at optimum efficiency	10	Sprinkler irrigation at optimum efficiency	6
7	Ecoseedin	5	Weeding	5
8	Inter culture	10	Inter culture	6
9	Intra row and inter cropping system	10	Subsequent cropping system	8
	Composite enhancement additive index	90	Composite enhancement additive index	60
	Multiplicative index	2.348	Multiplicative index	1.784
	Mean enhancement index= (1.9+2.348)/2=2.124	<b>2.124*</b>	Mean enhancement index= (1.6+1.784)/2=1.692	<b>1.692</b>

**Table 3:** Yield factors and response on yield increase for RACY -SRI COMBO and RACY-SIMM.

\*Note- paddy is high yielding crop, hence the composite yield enhancement factor is higher than that for finger millet.

of crop of finger millet and produce component responses. There might occur some variation in the response of individual assessment, but the composite/overall response will be reaching to the same. In case of the finger millet there is urgent need of develop some plant physiological innovation as had been the case for SRI. So far known stages are the booting stage, heading and grain filling stage. As such the physiological character which can induce profuse tillering and effective fingers, garain filling and crop harvest. Once this is accomplished, it will be ideal technology for cultivation of the minor millets. Sice the minor millets are largely from gramini family, they start growing at the advent of the rains. When cultivation technology is provided good and successful harvest become possible, that will help produce food under the adverse weather condition as well.

There is still further need of research to find how the factors in table can be modeled to develop accurate assessment of increase in the field [14]. As a middle path the average of two approaches i.e. summation and multiplicative are adopted for assessment of yield. These refinements will go in regular research endeavours.

State	Productivity	Average yield increase by factor 1.692	Remark
Andhra Pradesh	1128	1809	Overall 69% increase in yield occurred with scope for improvement and make up for short fall. This development enables scientific management of production of finger millet and other minor millets. The RACY-SIMM will enable development in quality improvement for patenting and Glr.
Bihar	811	1372	
Chhattisgarh	269	455	
Gujarat	835	1413	
Jharkhand	577	9763	
Karnataka	1808	3059	
Maharastra	982	1662	
Orissa	648	1096	
Tamilnadu	2130	3604	
Uttarakhand	1357	2296	
West Bengal	1138	1915	
Others	1011	1711	
All India	1570	2656	

**Table 4:** Yield enhancement in cultivation of finger millet.

It is visible from the yield values in table 4 that maximum productivity is in Tamil Nadu whereas maximum area under finger millet is in Karnataka. Yield level in Uttaranchal is third highest followed by that of Andhra Pradesh. Conversely, the lowest yield is in Chhattisgarh followed that in Jharkhand. The reason can be sequence of rainfall. The application of the ultimate green irrigation

practice might enhance yield in the low yield producing region. The RACY-SIMM is a unique practice applicable for all varied conditions, that enable identify the factor causing shortfall in yield. The shortfalls can be made up by input management. This technology offers unique opportunity for managing agricultural food production in arid and semiarid areas.

The scientific knowledge of application of sulphur cycle and absorption and adsorption are not so well perceived and applied in agriculture production practices. Therefore, there have been, in general, lack of innovation in natural primary and other secondary resources management. The status of knowledge, practice and their uses and misuses have lead to creating problem of pollution of water, soil, air and environment. For example, nitrate losses from the agricultural fields are blamed factor in the epidemics of blue baby disease and foster eutrophication of the water bodies. Knowledge of the nitrogen cycle enables to devise innovative measure to bring the atmospheric nitrogen by nitrogen fixing bacteria and make ground condition receptive of the nitrate that might come by the other natural way of thundering and rain. Detailed account of the management of Nitrogen cycle are reported in authors another study [7,9,15,16,].

### Crops and cropping pattern

The crops and cropping practices have been uniquely developed in the Racy nature land and water practice. Except leaving the part of genetics and plant breeding and varietal improvement all aspects are manoeuvred in this practice. These crops and sequential planting are devised based on the nitrogen cycle management. It is well known fact that atmosphere contains nearly four fifth part by volume by nitrogen gas. The nitrogen reaches to the ground by only two main routes viz by nitrogen fixation through nodulations in the leguminous crops and through the nitrate dropping from sky during thunder and rain. It is, therefore, chalked out cropping practice so that there occurs continuous buildup and utilization of nitrogen by crops. Detailed description is available in authors other studies [1,2,12,13]. New concept of eco agriculture were devised to eliminate the need of weeding i.e. creating crop cultivation by zero weeding, which is a development towards eco agriculture. The main basis is to suppress the weeds by ecological dominance of leguminous crops and fix nitrogen in soil. The practices of inter cropping are included as bands of rows of main crop and inter crops. In this situation the requirement of operation of the nitrogen cycle in every part of the field is inhibited, hence, benefit of nitrogen fixation cannot be achieved. Therefore, regular 1:1 or 1:2 crop ratios which can be accommodated in the wide spaces required for crops such as pigeon pea and castor [13]. In addition to the nitrogen fixation considerations are made to devise synergical effects of crop root development and nutrient extraction

from the soil. Hence, where nitrogen is fixed, suitable cereal crop is seeded at seed rate 50% of normal seed rate of the crop. Thus, considering all this aspects in entire scenario of cropping patterns are presented in table 5.

The eco-agriculture, intra row, intercropping and opportunity cropping (utilizing stored nitrogen by seeding cereal crop) are suitably devised for crops which maintain height almost similar to the height of paddy plant. The LER accruing due to different aspects are also devised based on the previous studies of the author, the total LER developed from 1.0 to 3.88 that gives manifold yield. Thus, pro-

ductivity equivalent of finger millet can be harnessed manifold. There is advantage of crop diversification, a case clear depiction of advantages of proked crop diversification. There have not been intercropping of such divers modes and resulting benefits. It is imperative that under all situations, eco-seeding has to be carried out for zero weeding, whether there occurs some yield harvest or not. Three crops are grown in intercropping as against earlier only two crops. Inclusion of long duration crops such as pigeon pea and castor utilizes the nitrogen fixed by the companion crop harvested prior to these crops. This fact had been well established by studies at Agra [1,12].

S. No	Main crops	Eco agriculture likely increase in LER	Intra row* Likely LER	Opportunity cropping, likely LER	Total LER
1	Finger Millet (Control)	-	-	-	1.0
2	Finger millet 25 x 10 cm Sole crop	GG@50 (.15)	GG @50 (1.51)	-	1.66
3	Finger Millet + GG 22.5 x 10 cm, Row 1:1+BY	GG @50 (0.15)	GG@50 (1.51)	GG@100 (1.54) +BY@50% (0.6)	3.80
4	GG/BG	GG/BB@50 (.15)	BY @50 (1.51)	FM@50 (.5)	2.16
5	Pigeon pea (60 x 15) + GG + FM	GG @50 (0.15)	GG@50 (1.51)	GG@100 (1.54) + FM@50 (.6)	3.8
6	Pigeon pea (60 x 15) + GG (30 x 10) + BY	GG @50 (0.15)	GG@50 (1.51)	GG@100 (1.61) + BY@50 (.6)	3.8
7	FM (25 x 19) + Sesame (25 x 7 cm), 1:1 + GG	GG @50 (0.15)	Sesame@50 (1.4)	Sesame@100 (1.54) GG @50 (.5)	3.59
8	Sesame 22.5 x 7 Regular Row	GG @50 (0.15)	GG@50 (1.5)		1.65
9	Sesame + GG 1:1 + FM	GG @50 (0.15)	GG@50 (1.51)	GG@100 (1.54) FM@50 (.5)	3.70
10	Castor (60x20) + GG 30 x 7 1:2 + FM	GG @50 (0.15)	GG@50 (1.51)	GG@100 (1.62) FM@50 (.6)	3.88
11	Castor (60 x 20) + FM 1:2	GG @50 (0.15)	GG@50 (1.51)	FM@100 (1.51) GG@50 (.6)	3.77

**Table 5:** Eco-agriculture, Intra row, inter cropping.

Based on study Yadav, *et al.* [1], Yadav [9].

\*\* Based on study Prakash., *et al* [12].

+ based on rational assessment

++ Based on review results Midya., *et al* [17].

### Accomplishments of the various impacts

The RACY\_SRI COMBO included detailed description of 17 impact indicators and nherent advantages that emerge from the practice. Here in RAY-SIMM these indices are enumerated in table 7. Crop weather resilience, Linkage, food security, Present and posterity, universal application, premises adoptable, erosion control, pri-

mary and secondary natural resources use, quality improvement, technology surpassing, correct ability, livelihood, tPneed, adoption resilience, GDP prone, social security and green technology. The RACY\_SIMM is at par effective with the RACY NATURE-SRI COMBO. In general agriculture in arid and semi-arid areas has been uncertain. The RACY -SIMM technology produces crop for certain.



S. No	The Indices	Racy Nature	RBC	SRI	Agri In Arid and Semi-arid Condition	Racy Nature-Sri Combo	Racy-Simm
1	Endurance	*	+		-	*	*
2	Linkage	*	*	*	-	**	*
3	Food security	*	*	*	-	**	*
4	Presenpost	*			-	*	*
5	Universalaplic	*			-	*	*
6	Premis adaptivab	*			-	*	*
7	Quimp	*			-	*	*
8	Eriscons	*	*	*	-	**	*
9	Primariseco	*			-	*	*
10	Technosurpass	*	*		-	*	*
11	Correctapability	*			-	*	*
12	Livelihood creation	*	*	*	-	**	*
13	TPneed	*	*		-	*	*
14	Adoptresili	*			-	*	*
15	GDP Prom	*	*		-	*	*
16	Social security	*	*	*	-	**	*
17	Green tech	*	*		-	*	*
	Efficiency score	17	10	5	0	17	17
	%	100	59	29	0	100	100

**Table 6:** Performance Indicator indices and developing scores.

\*The aspects are encompassed in the RACY nature- SRICOMBO

\*\* Very effective and sure way of bringing impact. Maximum two. \* as RACY COMBO comprises the components.

+ The blank boxes imply that either information is not known, not clear or does not apply.

### Product preparation

The finger millet is used as preferred food in many states. In Karnataka its large hectare indicates widespread use. The finger millet contains carbohydrate bit lower than wheat, but calcium and phosphorus contents are high. Thus, this is highly suitable as additive cereal for fortification of iron, calcium and phosphorus. The special character that exists with finger millet is that it gets digested slowly and maintains blood sugar constantly for longer time than many of the cereals. When production increases it can be used to prepare biscuits, which can be good for breakfast and food supplement in schools. Thus, use of finger millet will again become as preferred food item. New media reports have made general awareness that asthmatic problem is more in U.P and Bihar. Thus, food supplement of finger millet in other cereals will overcome problem of iron deficiency in, pregnant ladies and raise oxygen uptake during child bearing. The use of processed finger millet supplement will find extensive scope and the present technology should be extended in Bihar and Uttar Pradesh that will help making coming generation in sound health.

The dried stalks are useable as filling material for preparing ply board with Bamboo, which will be an alternative for wood. Thus, the ply board can be used for preparing houses and furniture. The finger millet will be a multiple use crop for human welfare. The finger millet is again gaining popularity on account of nutrient values and because of compulsion of its cultivation due climatic aberrations.

### Green mechanization for finger millet

The RACY NATURE involves bed configurations which apparently becomes item of worry for high energy input. The simple workable green mechanization has been created in the Racy nature which facilitates preparing the bed configuration of raised bed and furrow. The green irrigation facilitates building moisture fully oxidized, which is termed as ultimate green irrigation practice. Now the new super micro irrigation practice has been invented that will go long way in water conservation and coping with water and nutrient supply than ongoing practice of micro irrigation viz drip irrigation. A seeding machinery named High-tech seed drill was developed at Research Centre Agra, which suffered setback of unscientific

adversity. Now the eco seeding, fertilizer placement, seeding of intra crop, main crop and seeding of intercrop and the opportunity crops are to be done. One will see combine harvester moving around for harvesting of crops. This study has developed all basic specifications for development of seeding machine, which is more crucial and useful than harvester combine. It will be novel idea to develop a country combine for seeding of crops, which will be more resource creating than the harvesting combine. With this development agriculture brought to generation IV (4G) in the present study will get wing to fly to cover large areas in short crucial time for sowing of rainy season crops as worth remembering stanza: [Ghagh, s legendary poem 'TERH KARTIK, TEEN ASHARH JO Chooka So GAYA BAZAR'] ]Thirteen Kartik (October-November) and Three July, are right time of sowing are crucial, Anyone who fails in accomplishing sowing, he will have to depend on market. . It will be good to develop business process outsourcing (BPO) developed in earlier

study [1] in arid and semi-arid areas with large land holding to accomplish sowing and carryout Toil Free Eco agriculture. The finger millet can be threshed and food processed by the machines, which have been getting developed in many other institutions and utilized for other food commodities.

**Accomplishment of research needs**

The status book included research needs of finger millets to be carried out under All India Coordinates Scheme. Table 7 is prepared how most of the desired research needs are accomplished in the present study. Leaving aside the crop varieties and genetic improvement most of needs (almost 80%) have been accomplished as universal technology. Therefore, production of finger millet with high productivity can be accomplished by technology involving quantum mechanics and irrotational revolving mechanism.

S. No	ICAR	RACY-SIMM	Remark
1	Biotic and abiotic tresses	Ameliorated	*
2	Specific germplasm	- Not endeavoured	-
3	High yielding varieties	- Not endeavoured	-
4	Manures and fertilizers	Decisive technology developed	*
5	Bed configuration	Raised bed and furrow	*
6	Transplanting	30cmx10cm	*
7	Intra and inter cropping	Detailes given in text	*
8	Ecoseeding	New innovative tech developed	*
9	Ultimate irrigation	New innovative practice developed	*
10	Moisture, nutrient and crop management options available	All developed as quantum mechanics	*
11	Disease outbreaks of new diseases	Organic IPM	*
12	Row proportions for remunerativeinter	Decided as per inter crop	*
13	Harvesting	Selective, manual	*
14	Post harvest cultivation	Developed as a nitrogen cycle management	*
15	Fine tuning of the available machinery	Can be possible by mechanics assistance	*
16	Transfer of technology	Modussoperandii devised	*
17	Training of small-scale entrepreneurs	Training module and new selective product developed	*
	Total	Accomplished	15/18=88=83%

**Table 7:** Level of accomplishment by the present study in listed research priority of ICAR.

Almost 80% of research needs have been accomplished. The quantum mechanics eco agriculture should be tested at all coordinated centers. The development of quality should be patented and GI registered.

### Discussion

The present study has developed RACY-SIMM an eco-agriculture for intensification of finger millet in particular and any small millet in general. This development is at par the RACY NATURE-SRI COMBO developed for rice production [6], as generation III [3G] technology. Thus, these two eco toil free involving quantum mechanics supported by irrotational mechanics will full almost all needs of both rice and wheat for wet and winter crops with high productivity potential and other for arid and semiarid agriculture with high risk of success. These technologies enhance productivities and protect environment thus, eliminate wordly worry of global food shortage for the world population.

These two technologies are the sun technology as gainst some white spot technology [3]. Thus, when all agricultural methods and practices are uniform there will be development of some unique quality which will get patented and quality geographical registry (GI) made. This legalization/certification will facilitate rating of products and availability of quality products for the consumers. These day craze is developing for organic foods and these technologies have inbuilt component which eliminate or inactivate the heavy metals and toxic gases. Hence produce organic food for all and not for feul elite individuals.

The RACY-SIMM is basically land and water management combo for arid and semi-arid condition. Weed management by eco zero weeding agriculture is most recent technological breakthrough, as revealed by research studies [17] and non-feasible methods of weed management methods are getting developed and popularized. Krish Bhavan, building corridor reception counter lobby is fascinatingly displaying a giant mechanized measure for weed control, which has limitations of setup and low in enhancing yield of crop. Against such innovation, the eco-zero weeding agriculture is a superb technological breakthrough by this researcher, which has been applied as supporting technology for RACY-SIMM.

Nevertheless, it is felt that some plant physiological innovations are warranted as has been the case for the SRI. The planting pattern that manifested as eco agriculture, intra row planting, intercropping and opportunity cropping are the remarkable innovation of this kind in crop production technology. Since these technologies are based on innovative application of scientific facts, these qualify for general policy application and further refinement for short-fall by customization under local situations as depicted in figure 3. Thus, research needs have been accomplished and reduced to

maximization of some inputs. The remaining researches will get soon accomplished at low cost of investment and within the reasonable time limits. As indicated the BPO will work to facilitate operations and work as opinion leaders to promote extension of the technology.

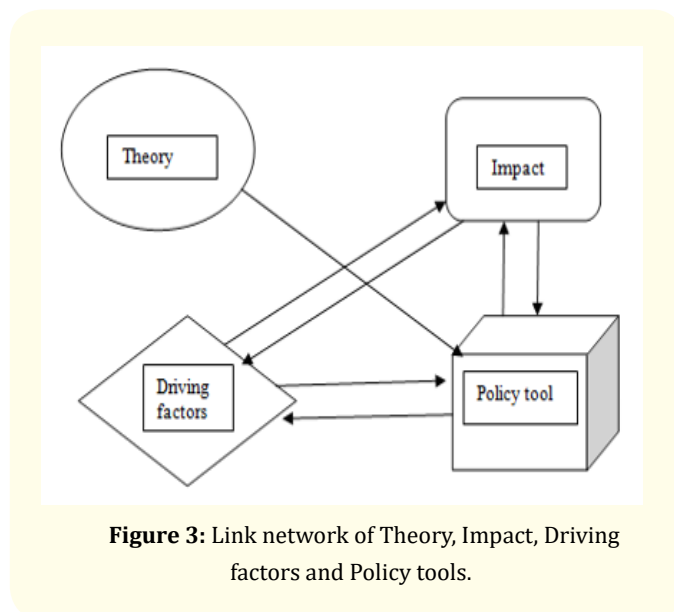


Figure 3: Link network of Theory, Impact, Driving factors and Policy tools.

The RACY-SIMM will bring vertical and horizontal expansion of minor millets which are getting preference on account of nutrition value and implications of weather aberrations. The cost of these commodities are also getting high. In the early times these crops were consumed as sole poor man’s food, but time has changed, where processing has transforming capability to create processed liking foods. The minor millets are getting popularity because of nutrient supplementing ability and industrial application. The venture of ply board making will open new application in addition to the food grain hence time has come careful development can take place. Because the technology of agriculture production is toil free and fast due to mechanization, creation of ply board making industry will be ideal development in arid and semi-arid areas.

The land holding has been decreasing, which calls for vertical growth of agriculture. As revealed in the present study, LER of 3.8 and above will be possible by application of knowledge of nitrogen cycle management. The technology utilizes primary and secondary natural resources. It creates new opportunity to produce diversification that permits improvement in poor, middle class and high society for keeping good health and wellness. The technology brings a social up liftment of poor, tribals, developed and city dwellers, where food supplement of finger millet will be useable in one form or the other. In early days the finger millet was used as poor man’s food, but in the present time it will be useable as medicated food for keeping good health and wellness. Thus, the RACY SIMM COMBO is

a very appropriate technological breakthrough to bring social and economic reform in low per capita land holding scenario developing in county.

Further, the technology is component application compensating, meaning thereby it will produce benefit proportion to the application of technology component, hence, this technology should be adopted without waiting for developments. The development of seeding combines when becomes reality, it will add speed of transformation and completion of target areas under the crop [18,19].

## Conclusion

The present study demonstrated utility of land and water technology and intensification of minor millet [RACY-SIMM] for production of high and sustainable yield of minor millets. It embodies quantum endowed with Irrotational mechanics, which has fixed mode and application module. The technology has created new plateau for yields to be achieved. All effort should be devoted to apply the technology and derive benefit from this research. Development of green mechanization, the seeding combine by involvement of BPO will relieve farmers from toil in agriculture to have enough time for other income generating activities. Development of Agro industries for food processes and ply-board making will provide seasonal employment in the arid and semi-arid areas. These developments will help cope up with food production under the aberrant weather conditions.

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