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Renaissance of Raised Bed and Furrow as Soil Nano Tech for Producing Global Food Sufficiency for Accomplishing Sustainable Development Goal

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Abstract

Purpose: Soil and land productivity were getting stagnated due to lack of plant nutrient sufficiency and suitable seed/planting bed formation, which provides suitable soil built environment, as habitat support to plants. Foresight of huge food production demand in the South East Asian Countries, developed countries viz U.S.A and Australia launched countrywide projects on raised beds and furrows (RBF), which produced good effects, but also showed limitations leading to no adoption of important agriculture practice by farmers.

Methods: Present research develop with envisioned scientific insight a new RBF the most satisfying all scientific features, converging seven different aspects of soil cation exchange capacity (EC) and also supported by recent supporting innovation, in a fixed module, feasible for formation and plausible adoption by farmers. This new nano technology, which also acts as auto draining and having high resilience to climate change. Was designated as Nano RBF (N-RBF.

Results: The N-RBF overcomes all past limitations and fulfilled with proving qualities different aspects of plant nutrients. Field experimental results on crop performance and enhanced yields produced almost three fold more yields than those harvested by non-participating farmers in vicinity of the experiment. Thus, the N-RBF is the best in domain of enhancing soil productivity by building plant nutrients.

Conclusions: The N RBF proved directly fulfilling aspects of almost by 71 % and positively supports remaining by 29 %, to go long way in fulfilling the sustainable development goal of Un Mission 2030. Thus, this research culminated in bringing nano-tech practice on soil productivity that becomes means to support food and many other developments for global gentry.

Keywords: Bed formation; Land and water; management practice; Nano-technology; productivity; Sustainable development goal; Changing climate

Introduction

Food is a life force for our families, cultures, and our communities. But profound changes in the way food is grown, processed, distributed, consumed, and wasted over the last several decades has led to increasing threats to a future of food that is sustainable, equitable, and secure. Food interconnects with all aspects of our lives: Water • Land • Energy • Culture • Jobs • Technology • Economies • Policies • Families, UN Secretary-General Anión planned a Food Systems Summit for 20221to raise global awareness and land global commitments and actions that would transform food systems to resolve not only hunger, but to reduce diet-related disease and heal the planet. The Secretary General called for collective action of all citizens to radically change the way people produce, process, and consume food. Since food is basic need for survival and growth, efforts had been all time to develop ways and means to produce more than that is going on. In the domain of food production, intensification in agriculture which began about seven decades ago practices of mechanized operations created compaction by traffic, which leads to loss of productivity. In order to overcome the problem of traffic a system of fixed row agriculture was visualized as solution to it, a system of fixed row cultivation was introduced, which took form of system of raised beds and furrows (RBF). This practice saved irrigation water and enhanced productivity of crops. This RBF later took shape of permanent raised bed and furrow (PRBF). Many developed countries particularly U.S.A and Australia jointly launched projects on the RBF in populous counties in South East Asia to demonstrate way of enhancing food production to fulfill increasing populations' food demands about six decades ago. The programs were sponsored by grants from different donor agencies. The RBF in use was becoming PRBF. The high wisdom direction and endeavors resulted increase of food production, but it could not become sustainable as people could not continue as a plausible practice due to emerging difficulties of non availability of the bed forming machineries, hardening of surface soil and problem of weed intensive growth and need of reshaping of furrows for restoration of the configuration of furrows. These associating problems with RBF or PRBF in those countries became cause of people not adopting and the practice almost left the ground. After almost two decades some research institutions endeavored to popularize the system of RBF, and lot of controversies and limitation made it to remain as item of research in Agricultural Universities and many crop based institutions of the apex research organization Indian Council of Agricultural Research. New Delhi. These researches remained busy in finding sizes of the beds and formation machineries, but it could not bring wide spread adoption again by agriculture practiceners. In the meantime several innovative researches emerged on the aspects which had been found as limitations such as problem of bed forming machineries, involvement of sorptivity for enhancing uniform fast crop stand establishments, eco-zero weeding to overcome huge problem of weed and crop losses and maintenance of sustainable soil moisture supply for good crop growth, manures and fertilizer applications etc [1,2]. Inspired by researches, and associated such developments in realty management, Parkinson and Rustam ji, aplication of Cation Exchange Capacity (CEC) was brought in the developing scenario for enhancing soil productivity with feasible means. In these scientific endeavors it culminated in to formation of raised beds and furrows (RBF) with tremendous prospects. Objective of the present study was to demonstrate utility of new RBF developed as a nano science to bring plentiful justifications in producing enhanced food sustainably. This manuscript comprises previous efforts, limitations, new innovations and their applications for enhancement in food crop yields. The study presents feasibility of adoption by people and justification as new advancement on enhancing soil and land productivity.

Materials and Methods

Summary of previous researches on RBF/PRBF

Envision for overcoming intensified traffic due to heavy machinery mechanization and development of compaction induced crop losses in agriculture led to genesis of the RBF. Studies on RBF began in USA and Australia spread in many countries of world and became practice of PRBF (Table 1). Thus, RBF got devised to overcome problems associated with mechanized agriculture, which proved successful in those countries viz USA and Australia. In those countries, the RBF got converted as Permanent Raised Bed and Furrow (PRBF) [3-6]. From USA and carried out researches on RBF and PRBF primarily in Australia and later on in South East Asian country viz Pakistan. Many other researches on RBF reported increase on enhancing yield and water use efficiency [7,8]. As time passed benefits got realized and research on RBF also got extended in coverage of areas under adoption. These countries and many International Organizations launched special funded projects to operationally demonstrate and popularize adoption of the RBF in Bangladesh, India, Indonesia, Nepal and Pakistan. Seeing improvements in productivity, saving in water and possible crop diversification features inducement by the RBF, China also launched its own countrywide project on the RBF. Although found effective in afore mentioned aspects of producing benefits, at the same time exhibited limitations of raised beds getting compacted, collapsing of beds in furrows leading to loss of crop line and developing weed intensified problem. There emerged need of machinery for formation of beds and combined effects of limitations resulted in no adoption of the RBF in such south East Asian Countries after closure of projects and accompanying funding. There existed cases of scanty researches on establishing efficacy and utility of such RBFs. Some researches tried to standardize size of raised beds and furrows, but it remained only with research centers and it could not catch scientific superiority attract users for adoption as practice. The developments on PRBFs which exists supporting long duration crops such as sugarcane, pigeon peas and semi long duration crops also could not get adopted by users in the south East Asian countries. Even in Australia the PRBs found useful for wet land conditions, are rarely adopted for sugarcane and cotton cultivation. This disappointing situation of non adoption of the PRBFs existed in almost all countries, where the specially funded projects were launched. There had been time to time research interests that showed diversification of cropping specially vegetables and medicinal crop cultivations [9]. Use of RBF for crop diversification. The confirmed utility of RBF and need of innovative researches to overcome the associating limitations so that it comes in wide adoption by the agriculture practiceners existed as a continuous demand. The RBF- an effective means of enhancing food production appeared as natural obvious way for developing food to support sustainable development goal (SDG) of the United Nations.

Appraisal of Limitation

As states in previous developments on RBF, there were problems of non availability of bed forming machineries, standard size of the RBFs, compaction of raised beds with time within the season, tremendous infestations of weeds and need of creating soft ground for next seeding /planting. These limitations became barriers for adoption of the good and effective practice of the RBF. These problems were innovatively solved, which will be brought out in result and discussion part of the study.

Cation exchange capacity (CEC) of soil as a sound basis

Cation Exchange Capacity (CEC) is physico-chemical characteristics of soil element forming plant nutrient uptake process. Contains all essential macro and micro plant nutrients having cations and anions charges. The cation promotion combining effect chemically to build essential compound those move to plants through root hairs. Ratio between cation and anion elements is 1:3, which implicates strong need of building strength in the cation factors for enhancing productive capacity of soil. This aspect had been the main thrust in present study. Long list of CEC factors invite careful endeavor build CEC factors of cations so that their compound producing capacities get boosted and factors promoting desertification get suppressed. Periodic Table gives a straight answer to the ionic charge, name, and mass of each element in the table. Equivalent weight (combining weight) is equal to atomic weight divided by valance [10]. X disputed as the European Union does not recognize chromium as an essential nutrient. Selenium produces negative effects on food quality and health hazards.

Need of innovative technologies on CEC factors

Innovations are needed for overcoming the limitations bogging down adoption of RBF, which has already proven to be highly effective in enhancing yield and water use efficiency. Visualization of feasible and efficient measure then could not bring the good practice of RBF get adopted by the farmers and agriculture practiceners. Further, in these endeavors uniform crop stand establishment remained as basic aspect which could not come to attention of researchers. Any shortfall in uniform crop stand establishment can bring make up in situation by later measures. To overcome the problems stand establishment soil physicist remained busy in solving problem of soil crust formation, which impedes seedling emergence. Therefore, raising seedlings and transplanting at regular spacing s, largely adopted for small seed crops and horticulture remained as ongoing practice. However, directly seeded crops still needed innovative measures to overcome problem by simple way. Innovative studies enabled development of fast and uniform crop stand in the field as well as in seed bed formed as NRBF. Such innovation implies that once uniform crop stand is established many subsequent reforms will uplift the crop to produce lateral and vertical growth comprising high yield of crops/ha.

Sorptivity

Sorptivity is a process of building capacity of seeds to absorb water content to sprout and starrt emergence in seeds to be used in regular sowing or seeding for nursery raising for use in subsequent transplanting. The seed soaked in normal well or canal water for 6-10 hours (slightly for lower duration for pulses), then keeping under shed covered with gunny bag cloth. Seeds will start plumule initiation. This prepared seed is sown in field following final shaping of NRBF. So far there had been lack of suitable seeding machineries for sowing of swollen seed to maintain optimum pants per ha of field.

N-3 based CEC- ECO -ZERO weeding for weed management

Plentiful advancement had been made in development of eco-zero weeding, eliminating need of any subsequent secondary tillage operation for removing weeds. The basis, experimentation, results and its multiple benefits have been documented [11-16]. This eco zero weeding fixes dynamic Nitrogen (N), which produces unimaginable yield compensating yield loss and bringing still higher unimaginable crop yield. Details will be presented in result part of the study.

S-2 based CEC improvement

In first CEC catiour is N. Innovative development based on application of nitrogen cycle management was reported by study [17]. S based CEC factor is second in list (Table 2). Detailed study on S was accomplished [18]. Crisp results of the innovative development fostering productivity will be taken up in result part of study.

O-2 based CEC

This factor is fostered in the N RBF in form of a practice which inherently get enhanced in NRBF. The detail available in study will be brought out in result part of study.

C-4 carbon based CEC

The addition of carbon is through organic manure viz compost. Expeimental studies have established that one forth of N required be supplemented through biological N sources. Guiding principle is that C: N >2. Therefore, the C:N ratio indicates levels of building the levels of C. Thus, building N will compensate C. This fact supports strongly many innovations on N supplementation will be complementing C.

I-2 based CEC

Iodine is CEC factor which governs food quality. This I is derived from soil. Hills and Tarai (areas adjacent foot hills) regions and coastal regions suffer set back of erosion of iodine (I), indicating severity of low I containing food and incidence of goiter. The coastal peoples' diet containing fish is, however restored, but shortage of I content in Hills and foot hills becomes crucially low and prevalence of health hazard of goiter. Fish manure in any form, be compost and tankage, is the possible way of maintaining the level of I. Thus, utility of RBF is highly extendable in hilly, foot hill lands and in as well as costal land treatment measures. This fact is providing as a new clue on enhancing productivity of soil.

Clay-3 based CEC

Clay content is main source of causing turbidity in water. It always remains in suspension. In spite of any type of soil conservation measures clay move with runoff that means clay loss from the soil in the field is through wash off. The best possible way to restore is to store water in pond where clay settles and when water dries down, it is lifted and reapplied in field. The clay loss from fields implicates dual problem of loss of productivity and when water treatment is carried out for domestic water supply, it demand chemical and treatment by flocculation and filtration, thereby meaning huge cost. Government of India have running program of Mahatama Gandhi National Rural Employment Guaranty Act (MNREGA), where ponds and water storage bodies are re-excavated under the employment of 150 day's work per person. However, the utility of the Clay is not visualized in that program. The new use of building CEC through this clay in the sandy soil with low clay content will be ideal way of restoring soil productivity. Thus, increased utility, demand and revenue can become source for enhancement in wages and no of peoples' employment. This aspect is taken up by the author in another program of combating desertification. The aspect will be dealt with in different study. Now coming to N-RBF the 92 % of field saved from wash off process of deep flow, hence there is low risk of loss of clay in wash off. The land parcel length of 18 m is good for conserving soil loss [19]. Therefore, N-RBF is self conserving clay and maintaining soil productivity.

Humic based CEC

The effect of humification is acquired by way of tankage. The tannakage enhances N and P content of organic manure sources. RBF maintains moisture in raised bed under aerobic condition which fulfills all needed environmental condition to make sulphur cycle follow aerobic route and produce sulphate. This process supplements the S another factor of CEC, which produces high harvest index. Results of this technology will be taken up in result part of the study.

Super micro irrigation

Super micro irrigation overcomes adverse impact of climate change, providing crop insurance. The NRBF creates improved soil environment that foster oxygen supply and sufficient moisture enabling uptake of nutrients through root hairs. The raised beds provide 92 % of fields to occupy ideal situation. Remaining 8% will be manageable for growing high moisture loving crops viz paddy. Such ideal field conditions can never be acquired by any measure for enhancing soil productivity.

Possible formable types of seed/planting beds

(Figure 1) sows the possible bed formable features after creating land to acquire flat land with permissible slope ranges for arable lands. So far widely used flat lands are tilled and seeding/planting done. Several researches had been putting endeavors to create soil tilth, smoothen land surface; even laser leveling is fondly performed as the most advanced technology. Laser leveling makes uniform spread of water in flat land, but it does not bring any beneficial improvement in environment for prospecting harvest. Laser leveling improves application efficiency of irrigation water. Likewise, ridge and furrow is widely adopted practice for some row crops and saving in irrigation water demand is made. The other way of bed formation could be raised bed and furrow, which took shape of PRBF in originating countries, but still not popularly adopted. In the present study a new nano tech RBF (N-RBF) with sufficient justification can be formed. Only this practice among all bed forming practices, envisioned and attempts enhancement of soil productivity through building CEC of soil. Assessment based limitations and gains from the nano tech RBF will be presented in result part of the study. The nano tech will overcome limitations encountered in previously attempted popularization of the already established by previous studies.

Racy nature agriculture

In innovative practice with characteristics of being alive, smart and enthusiastic (RACY) nature agriculture where all activities had innovative individual component factors was devised. The contribution of individual factors on enhancement of yield was established from long time research results. There can be some small variations in individual effects of factors, but combined effect on enhancing crop productivity will be reaching to almost same level. It is evident that the nature based quantum (fixed pattern which is universally applicable) agriculture it requires planning of associated activities to make the benefits produced by succeeding crops produces good effect on the following crops that will reflect the increase in crop yields for the N-RBF. In universalized application, the factor isolated in (Table 3). Provide scientific vision to identify any weak one, which can be suitably supplemented to bring yield to expected level. This will enable create scientific man oeuvre of agriculture production system. Implicating results will be presented in result part of study.

Experimental study on enhancing yield of wheat after paddy

Depicting all possible improvements for preparation of seed bed/planting beds that have been practiced (flat and ridge and furrow) and PRBF researched for five decades have provided experience and appraisal of utility and efficacy. The study conducted on CEC enhancement is presented here to prove efficacy of CEC based measures i.e. nano technology on enhancing soil productivity. Sequential preparation and operations adopted in the field study are given (Table 4). Various supporting components in the field study support building enhanced CEC and establishing crop yield level for comparison with yields from different occurring CEC levels. The treatments under the eco creating conditions were not weeded and the system was named as eco-zero weeding. Several aspects of eco-zero weeding have been documented. Aspects of water use efficiency and resilience to climate aspects are presented herein the present study.

Results

The past researches

The previous dealing on genesis, development, use and deriving benefits and its popularizations established that RBF is effective practice by building CEC improvement in soil as habitat [20] and conditions of varying type, be slope limited, wetness, drainage and physic- chemical characteristics etc. The studies revealed in enhancement of yield and water use efficiencies. The formation of RGF had some limitations which became barrier for its adoption. The associated limitations becoming barriers were also dealt with.

Limitations in past practice of PRBF and attempted measures for their elimination and overcoming

Development of flat land had been last resort of ideal land capability class and improvement of arable lands. The flat land has been widely practiced with flood irrigation, particularly for close growing gramini family crops viz wheat and barley and paddy. Widely spaced crops had been brought under ridge and furrow. This ridge and furrow had been an innovation claimed by International Crop Research Institute for SemiArid Tropics (ICRISAT), Hyderabad, India in initial period following its establishment. Ridge and furrow, a prominent practice for cultivation of maize in Northern Nigeria was disapproved after several years of research, by a British Senior Soil Scientist in 1968. It was concluded that use of ridge and furrow is not superior to flatland cultivation of maize. Almost during same time All India Research Project on Dry Land was launched with technical and financial support from Canada, there too existed no research establishing use of the RBF.

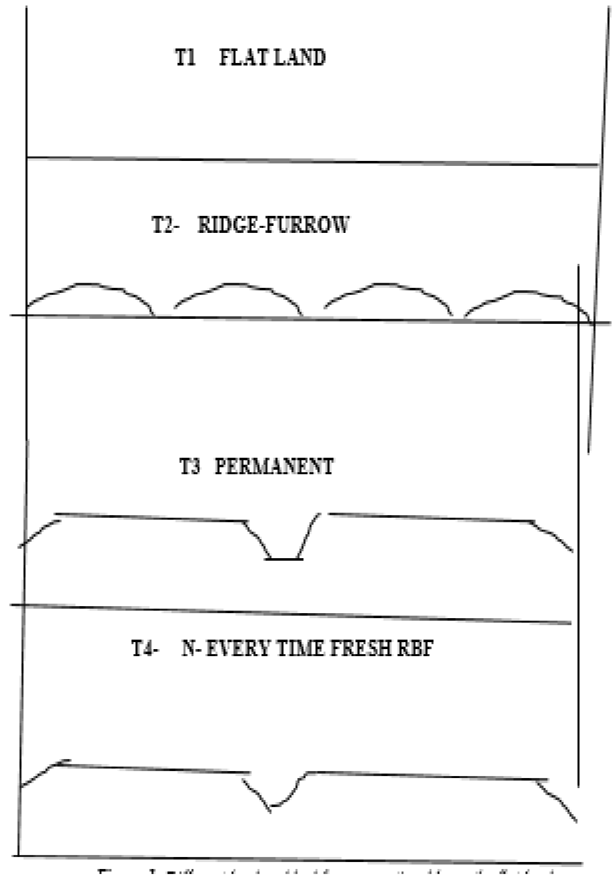


Figure 1: *Different land and bed forms practiceable on the flat lands.*

Previous presented details in section 2.1 and 3.1 substantially established the fact brought out here establish that there was no practice of RBF. However, in mid 1970s research works started appearing on the RBFs. Section 2.1 and 3.2 devoted on ongoing and wide spread production of food for huge population growth, which can be taken up pro-action of Soil Scientists, Agronomist and Agricultural Engineer at time of Green revolution in seventies. The benefits and opportunities inspired scientists to conduct research and solve associated problems, as elaborated in the previous sections. The present study took the CEC as base for making it nano technology and solving the associated problems then and making the N-RBF highly effective and innovative science based practice for its feasible easy adoption. Thus, the present research proved that N RBF is the best possible practice for enhancing soil productivity and render it for wide spread adoption by agriculture practiceners. Taking these situations different types of seedbed /land formation were devised in Figure 1. Various limitations are presented in (Table 5). The details on various aspects support that RBF had been new innovation, which had been devised in USA and Australia, produced good effects on yield and saving in irrigation water and fostering crop diversification. However, due to many inherent limitations and difficulties cited the RBF could not be adopted. The innovations and justification of CEC make the every time freshly made (N-RBF) is the most scientifically devised practice that would be adopted by agriculture practiceners. The N RBF is able to overcome all limitations and render it gat plausibly adopted by agriculturists. Every time freshly made T4 N-RBF with innovative measures becomes free of limitataions for plausible adoption by agriculturists. Limitations and problems associated with different seedbed/ planting bed formations for enhancing productivity

The CEC nano technology N- RBF

The CEC is ion based character of sol plant nutrient management and taken up in the present study, hence it forms nano technology supported practice. There might be such chemical reactions in RBF happening, Present thrust on CEC open enhanced opportunity and scopes for building soil productivity through this nano technology. This aspect had been adequately established in Section 2.3 and In this domain realization of this Physico-Chemical characteristics leads to development of nano technology fostered practice of N-RBF.

Reappraisal of ideal habitat creation by N-RBF and management of nutrient supply

(Table 6) Consisting detail step wise calculations prove situation with N-RBF that creates almost 92 % of land in moisture and oxygen containing ideal soil plant relation for enhancing yield of crop. Remaining about 8% land is with high moisture and serves as runoff disposal management. Thus, N RBF is the most perfect and effective innovation for building soil environment (Eherler and Goss, 2003) on enhancing soil productivity. Further, this type of RBF saves almost 30 saving in irrigation water, as established by almost all researches conducted during last seven decades. Optimum land length to eliminate rill erosion and wash off restricted by growing cop in parcel [21] ++Cross section of water spread .045x400/100=.18m

N based nanotechnology

In the N is the first CEC building factor, largely fortifications of N have been through chemical nitrogen supplementation. There have been multifaced advancements on nitrogen cycle management which plentifully supplement the N based productivity through CEC. The innovations created practices of eco zero weeding Intercropping Intra Row cropping [22]. Opportunity cropping and probabilistic green water use cropping. The combined N based CEC built enhancement was present in study It was established that almost four fold yield enhancement buildup occurs by a single, but prominent N CEC factor. The N based CEC fostered practices besides enhancing yield bring other multiple benefits and reformation in useful changes in daily life of people. The N bases CEC fortification of the N-RBF will be manageable that will enhance productivity of soil in exponential order. The N based CEC fortification can be brought when RBF is freshly made at the time of seeding or even prior to transplantation. Based technology The Sulphur (S based) CEC is second in the list the cation exchange capacity factors of equal importance. The important factor was not brought out in use in previous practices, as established by study [23]. Study presents details of how the S based CEC can be built in the natural process. The S based CEC fortification has important implication of enhancing yield and crop harvest index. The S based CEC improves quality character of food commodity. The supplementation is brought by aerobically decomposed compost, which is known as NADEP composting in some part of India. The NADEP contains Sulphur, which had been fully substantiated by Studies [24]. The S based fortification needs pre preparation and incorporation in field before formation of N-RBF.

O based

Study by added support of enhancement in efficacy of oxygen in root zone on enhancement of yield. Formation of flat land in to raised beds and furrow enables creating almost 92 % of the flat field to have with adequate oxygen supply, which otherwise gets affected by flooding. Remaining 8% with adequate moisture supply will enable raising high water demanding crops such as paddy. Thus, raised beds with adequate oxygen in soil crops such as maize and pulses will grow profusely. Thus, RBF enables crop diversification in field which had been main thrust of introduction of RBF in the previous researches which took form of PRBF in Bangladesh, Indonesia and Nepal. Thus, N-RBF will bring new agriculture scenario emerging as solution for creating sustainable agriculture under climate change.

Carbon based

As brought out in subsection 2.4-2-7, application of one fourth of N requirement needs supplementation for producing the maximum yield with integrated nutrient management. The enhanced N and P will be covered with presently available organic manure. Therefore, it requires application of organic manure which acts CEC buildup. The amendment and its incorporation should be completed at least 20 days before formation of N-RBF as well sowing. Thus, this fact support justification of recommended doses of NPK and on forth of its supplementation by organic manure to be adopted to produce large quantity of food for overcoming hunger and making nutritional food for the large global population. This fact also becomes convincing ground to organic loving people to use organic seed spices and fulfilling human body requirement for ion balance and let entire land resources be brought under cereals and pulses.

I based CEC

Bio-technologies were developed to enhance nutrient capacity of iodine in irrigation water. The tankaged fish manure as well as irrigation water will enrich iodine in food commodity. This scientific fact encourage passing irrigation water trough fish rearing tank that will become nondispensable use of water aiding water productivity.

Clay based

Clay content will enhance cation exchange capacity. Engineering method is on blue print that will bring clay available in ponds and lakes to go for extensive use for combating desertification.

Humic based enhancement of CEC

Humification enhances ranges of N and P content. The scope of enhancing N and P from low to very high range in field is depicted in (Table 7). This knowledge opens frontiers for preparing organic manure and P supplementation for enhancing CEC. Available low content compost when tankaged it can be utilized to cover large areas and productivity of soil restored. The ongoing practice of collecting cow dung from individual farmers' and making organic manure does not involve tankaging. This aspect is not known to the project launchers in many states, where the practice claimed as prospecting ventures in some states in India. Further in the past, there used to be project on cow dung gas plant, where slurry is dried and use for various purposes. Low working efficiency of the Cow dung gas plant project could not be sustained. Realization of this new scientific fact may help restoration of the Cow dung plants a superior practice to direcly using dung in field or for going to other uses.

Racy nature agriculture

Contained details of associated package of practices that will enhance efficacy of N-RBF. This is true for all kind of innovations in agriculture practices. It is clear that the entire supporting practices occur at different time, but in definite sequence. Hence, in order to make it highly effective the practices should revolve in irrotational movement for making agriculture highly sustainable. The long list of practices and activities follow sequence hence one after the other [25, 26]. In this respect RACY nature quantum agriculture fosters chain, where some practices need special time for preparation and making it effective. Example case is brought here for production of wheat for eliminating hunger.

High sustainable productivity of wheat

Aspects which add strength to the CEC factors in enhancing soil productivity are taken up in the following.

Germination, emergence, stand establishment, growth prospects and saving of irrigation

The method and activities' details were set in . Here the influence of sorptivity that established uniform wheat crop initial stand sown on about a month late from normal date of sowing in first to second week of sowing. The CEC of N and S were brought here by sowing 50% of normal seed rate of fenugreek that fixed N and side by side S [27]. That solubilized the phosphorus got fixed up during the previous paddy crop. The scenario of good effect is revealed by (Figure 2). Crop deep green color and uniform crop stand after first irrigation ie 21 days after sowing. Uniformity of crop stand established by sorptivity, vigorous growth and deep colored chlorophyll reveal very good prospects of high yielding harvest. The crop was given second irrigation about 66 days after the sowing. Thus, crop matured with tow irrigation (Pre sowing field preparation) plus two subsequent irrigations, bringing saving in irrigation water. All agricultural activities depicted vide table can be conveniently carried out in raised beds which become available with NRBF. Thus, saving of irrigation water in terms of volume will be still larger than 30 %, as established in.

Figure 2: *Scenario of crop after first irrigation on farmer's field after harvest of paddy.*

Yield enhancement

Following irrigation no weeding and top dressing of urea no other agricultural operation was carried out. During the time of crop at nearing stage there occurred strong wind that caused lodging of wheat crop, in general. Before harvesting wheat crop samples of 1mx1m were harvested from the experiment and adjoining fields not under experiment. The sample yield, grain filling in selected ear heads, their weights was monitored to assess makeup of delay in grain filling, grain no and weight of grain to establish lateral and vertical enhancement of yield by the associated innovative practices. It was observed that sorptivity made up emergence and crop stand establishment of about a week. The grain filling was closer to that of crop sown about a month before. These facts showed resilience and compensating effect. On an average the no of wheat plants bearing ear heads were about 1100 plants/m 2. High density plant population lead to enhanced yield of about 110 q/ha. Thus, lateral and vertical growth contributed to enhance crop yield as a result of plant nutrient viz N,P, K and S uptake raised by CEC of soil ranging from 0- 10 and 35q/has (Table 8). Developed with cropping scenario and crop yield from sites and fields situation surrounding the experimental sites. The scenario wise yield at a given site depicts scope of land and water management practice to make huge difference between harvests and become able to provide support for livelihood. Close look of data on yield in also revealed almost over three fold yield with associating technologies made accompanying component of N-RBF. In the racy nature agriculture integrated practice when RBF is included, it will have enhanced yield by 10 % or more. With these facts the yield levels can be confidently taken as 110 a/ha. When all practices of Racy nature agriculture, particularly S based nano tech that creates high harvest index is adopted, the yield will likely reach unimaginable yield up to140 q/ha. Lastly, when nitrogen cycle management based opportunity cropping is carried out; the equivalent yield of wheat will go up to 172q/ ha during the winter season. The yields levels might appear non believable, but these figures are harvested yields in experiment on demonstration plot on the farmers field. Thus the results build confidence in importance of CEC in bringing advancement in agriculture.

Applicability of CEC building measures on yield enhancement of different wheat varieties

(Figure 3) shows yields of different varieties of wheat recommended for different regions and their variations. The nature base agriculture with recommended varieties produce more yield than that any crop in India. It is confidently concluded that Racy nature agriculture, where N-RBF is an important component practice, it will enhance yields of all wheat varieties and under all locations. This is certain that wheat production will get substantially enhanced at all locations as the practice is applicable under all situations. There might come some shortfall in expected yield, the weak link can be identified and its suitable fortification can be made to produce yield at expected level [28]. Thus, total enhanced yield will eliminate hunger and enable fulfilling sustainable development goal.

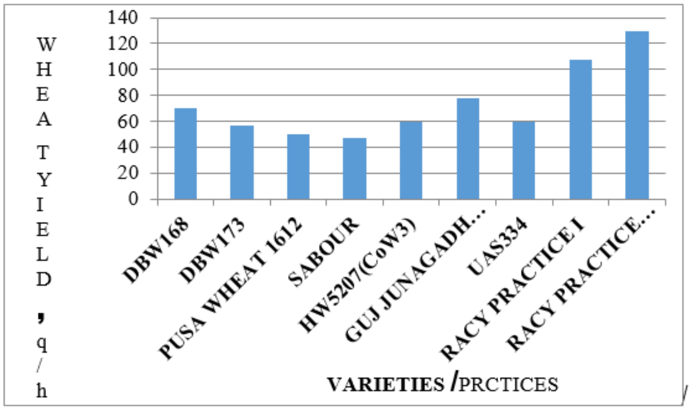


Figure 3: *Comparison of yields of wheat variety and yield harvested in field.*

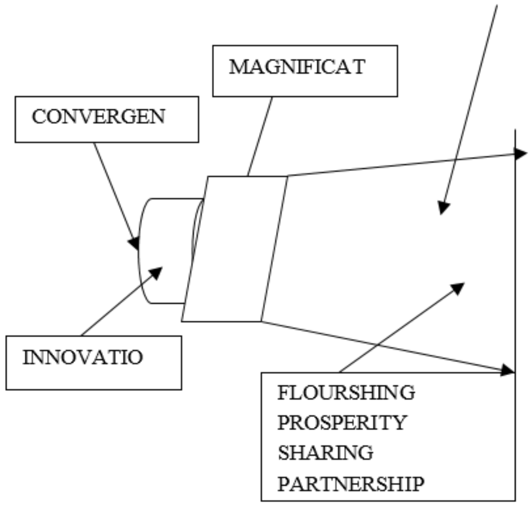


Figure 4: *Is an ideal representation of aspects by convergence.*

Proportionate contribution of CEC factors in yield production

The fore gone description and dealing with CEC factors, a summary was drawn to develop quick grasp of factors' importance, practice for accomplishment and relative importance in yield enhancements by N-RBF. The share in yield enhancement becomes sound academic basis to display utility and importance of CEC factors and their management. This information becomes making basis for soil and plant nutrients in agriculture world over. There have been in one way or the other things moving and producing some innovative practices in isolation, the study here presented a composite picture in form of nano technology. The factors influence increase in yield as well as quality. Nitrogen content brings amino acids, S enhancement brings strength through sulphur compound in food, and increase in iodine content eliminates health hazards by goiter. Innovations on N cycle based practices have tremendous potential for producing food commodity. The super micro irrigation brings sustainability and resilience in agriculture under climate change. Thus, CEC based N RBF evolved transformation and fostered dual strategy of food and health. These facts add value to N RBF and attraction for adoption for global sustainable development.

Table 1: *Review of status of RBFs system as a worldwide practice adoption scenarios.*

S.No	Country	Cooperating Institutions	No of cases / (%) share	Main Thrust	Beneficial factors			
					Yield increase, %	Irrig Saving	N fixation	Land improvement
1	Australia	Alone as leader	8(37)	Many	10	30	N	Wet land improvement
2	Bangladesh	Bangladesh Agri Sci, Cornel University, CIMMET and Nepal	2(9)	Diversification	10	Better field condition		Enhance crop yield, adopted area
3	China	Chinese Academies	2(9)	Production	24-46	75mm	Bed planter /machine	40, 000 ha under PRBs
4	India	PAU Ludhiana, Hissar and, SVP Univ Meerut	3(14)	Production				Better crop harvest index
5	Indonesia	Indonesian Univ and Victoria Univ Australia	2(9)	Diversification	11			
6	Mexico	ACIAR, Mexico Commit	1(5)	Diversification				
7	Philippines	Crop, Waters Div, IRRI, Manila	1(4)	Diversification				
8	Pakistan	ACIAR	3(15)	Production and crop diversification	Maize 30% and wheat 13%	Maize 32% and wheat36 %		
Total			22 (100)					i

Table 2*: Elements needed for plant growth affecting plant growth and desertification.*

S.No	Element	Symbol	Atomic weight	Common valance	Equivalent weight	CEC Factors
1	**2**	***3***	***3***	***4***	***5***	***6***
1	Nitrogen	N	14	3^-	-	*
2	Phosphorus	P	31	5^+	6.0	
3	Potassium	K	39.1	1^+	39.1	
4	Calcium	Ca	40.1	2^+	20.0	
5	Magnesium	Mg	24.3	2^+	12.2	
6	Iron	Fe	55.8	2^+	27.9	
7	Manganese	Mn	54.9	2^+	27.5	
8	Boron	B	10.8	3^+	3.6	
9	Sulphur	S	32.1	2^-	16.0	*
10	Zinc	Zn	65.4	$^{2+}$	32.7	

11	Copper	Cu	63.5	2^+	31.8	
12	Hydrogen	H	1.0	1+	1.0	
13	Oxygen	O	16.0	2^-	8.0	*
14	Carbon	C^-	12.0	4^-	3.0	*
16	Cobalt	Co	60	3	20.0	
17	Chromium	Cr	58			X
18	Iodine	I	53	1^-	53.0	*
19	Molybdenum	Mo	42			
20	Selenium	Se	79	2^-	39.0	#
21	Clay (montmorillonite)			1^-		*
22	Organic matter (humid substance)					*
	Productive factor	7				$1^{-1}:3^+$
	Desertification causing factors	15				$3^+:1^{-1}$

Table 3: *Conservative assessment of yield enhancement by alive, smart and enthusiastic (racy) nature agriculture practice components and their justification.*

S. No	**Racy nature agriculture practice component**	**Increase, %**	**Aspects of optimizations**
1	Aerobically decomposed manure, (NADEP) application	15	The one fourth of nutrient n should be supplemented by organic manures.
2	Ploughing	5	Ploughing creates aeration that convenes aerobic decomposition
3	Formation of raised bed and furrow system	10	It increases soil depth to store larger volume of moisture and air in the root zone.
4	Application of activated charcoal for bio remediation	Improved quality	Heavy metals such as iron, zinc, manganese, and copper and chlorinated organics get absorbed by the activated charcoal.
5	Precision sowing	5	The precision sowing enable harness yields from entire space of the field under crop.
6	Maintenance of optimum plant density	10	Optimum plant density will bring vertical growth and yield.
7	Establishing zero weeding pulse based ecology	5	It will save nutrient and moisture removed by weeds
8	Ultimate green irrigation	10	Sprinkler irrigation produces green water and saves irrigation water volume.
9	Weeding	-	No weeding will mean toil free agriculture.
10	Inter culture	10	It will enhance aeration during the crop growth in the field.
11	Subsequent cropping system	5	Post harvest cultivation will reduce at least 10% of total yearly GHGs emission.

12	Infrastructure for crop drying	To be assessed	An innovative pyramid roof top building developed to create built space for protection from aberrant weather and crop drying.
13	Composite enhancement additive index	75	Combined additive effect of all factors enumerated above.
	Multiplicative index	2.047	Combined multiplicative effect of above all factors
	Average	1.8985	(1.75 2.047)/2= 1.8985

Table 4: *Sequential field operations for wheat crop production under farmers' field study.*

S.No	Date	Activity	Effect	Remark
1	June 2017	Previous crop wheat harvested in April	Normal paddy cultivation due	Eco zero established field
2	-July, 2017	FYM in June before transplanting of paddy	Good crop of paddy	Cropping under rice wheat cultivation
3	November2017	Harvest of paddy	Field getting free from paddy and ready for wheat cropping	Ready to be sown as usual
4	Rotavator tilling	Initial field preparation	-	Common cultivation practice
5	Last week Nov 2017	Pre sowing irrigation	Pre sowing irrigation	Common NPK application
6	Dec,2017	Field prepared for sowing	Crop sowing by broad casting	Improved practice of seed soaking
7	20-12-2017	Wheat seed P treatment	Germination , emergence and crop stand establishment	Wheat crop sown but even covering done on third day of soaked sown / broadcasted
8	,,	Wheat variety PBW -343, seed rate 100kg/ha	Crop growing as usual	Germination was seen in field
9	7-2- 2018	1^{st} irrigation	By flat bed flooding	1 st irrigation
10		Top dressing of urea		
11	15-2-2018	Photograph of crop in field	Exemplary crop stand and growth	Photographs plate 1 Plates 2
12	12-3-2018	Second irrigation at year head	Flat bed flooding	Photograph plate 3
13	13/14-3-2018	Top dressing of urea		Crop growth progressing
14	4-4-2018	Crop nearing maturity and harvest		Photograph Plate 4
15	14-4-2018	Crop harvest	Sampling	Good enhanced yield

Table 5: *Limitations and problems associated with different seedbed/ planting bed formations for enhancing productivity.*

S.No	Limitations	Different bed formation practices			
		T1-FL	T2-RF	T3-PRBF	T4-NRBF
1	No availability of bed forming machinery	No need	Available	Not available	Means devised
2	Uncertainty of size and ratio of bed to furrow	Do	Do	Carry out	Fixed 1.8m
3	Beds getting compacted	As usual	Not applicable	Severe problem	Ameliorated

4	Intense problem of weed	Severe	severe	Severe	Innovative Eco-zero weeding
5	Slumping of raised beds leading to loss of crop line	No situation	Reshaped by earthlings	Severe problem	Not foreseen
6	Maintenance of uniform moisture when irrigated by furrow irrigation	Irrigation method	No situation arise	Problem with irrigation water	Super micro irrigation developed
7	Building different zones of moisture and nutrient fostering crop diversification	Not possible	Ridge and furrow	Problem existed	New opportunity created

***Table 6**: Operational details of wheat crop with super micro irrigation under experiment.*

S.No	Nomenclature	Unit	Size	% net with		Remark
1	With of raised beds	m	1.8 m with 15cm half furrow	Raised bed	Furrow	Saving irrigation water
2	No of such segments/100m width of field	No	55.56	1.65	.15	
3	Total equivalent widths under beds as well as furrows/100 m width.	m	55.56	91.674	8.334	
4	Length of raised be parcel for furrow irrigation	m	18 *	18	18	
5	No of such long land parcels/100m long field	No	5.5556	5 sets and sixth set of 10m	5 sets and sixth set of 10m,	
6	Area under raised beds and furrows	ha	1	.91674	.08334	
7	Saving in irrigation with furrow over flood irrigating 33 mm as flooded and 200% over flooded furrow section	ha.m	1	.033		
8	Water per overhead irrigation.033x8=0.264ha.m	ha.m		0.264	.264	

9	Total irrigation for wheat 33x8=.165 as over head and two furrow irrigation 0.18x.0833=.015 ha m water required for furrow irrigation=.0015hm	ha m	.264	.264	.015	
10	Total irrigation by super micro irrigation with two furrow irrigation		.279			
11	Flood irrig. flat land 4 no 10 cm each .279/.4=.699%	ha m	.4		.279	30%

Table 7*: Effect of humification by tankage on enhancement of Nitrogen (N) and Phosphorus (P).*

S.No	**Item**	**Content**	**Tankage**
	Biological Nitrogen, %		
1	Fish	4-6.5	6.5-10
2	Meal meat	10-11	
3	Poultry manure	2.5	10
4	Guano Bird dropping feeding or aquatic fish		10
	Biological Phosphorus, %		
6	Fish (acid)	3-6	4-8
7	Poultry	0.65	3-13
9	Guano		10

Table 8: *Wheat yield scenario at site of the experimental study reported in the present research.*

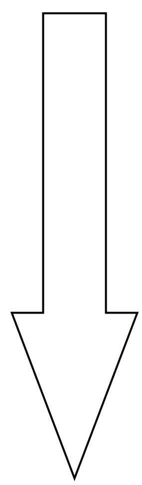
S.NO	**Ground condition**	**Characteristics**	**Yield, q/ha**	**Main driving factor**	**Eradication of hunger**
Sce I	No sowing	Water logged and saline	0	Discouragement	
Sce II	Sowing	No innovation adoption	10	Forced by food need	
Sce III	Sowing and inadequate fertility	Adoption of ongoing practices	20	Forced by increasing family need	
Sce IV	Sowing with RNPK	Sowing recommended package of NPK	33	Adoption of recommended nutrient	
SceV	RNPK+CECN,S	Early adoption of package of CEC practices	100	RNPK and CEC	
Sce VI	N-RBF +NPK+ CEC	RBF + Package of CEC practice	110	Nutrient and CEC +NRBF	
Sce VII	N-RBF +NPK+ CEC	All package of N-RBF and associating innovations	140	Meticulous adoption of Package of all practices	
Sce VIII	N-RBF +NPK+ CEC + Opportunity cropping	ScVII + Opportunity Cropping	172	Innovative practice N cycle management	

Table 9: *CEC elements, transformed practices and proportionate contribution to yield enhancement.*

S.NO	CEC Element	Nomenclature	Building Practice	Coefficient of increase	Remark
1	N	Nitrogen	N Cycle mgmt	0.5	The proportional factors reveal importance of elements and prospecting innovation accomplishment
2	S	Sulphur	S Cycle Mgmt, NADEP	0.1	
3	O	Oxygen	RBF	0.15	
4	C	Carbon	Compost	0.15	
5	I	Iodine	Fishery tank irrig. water	0.05	
6	C1	Clay content	Soil Content	0.05	
7	Humic	Humification	Tankaged	Induces sustainability	
7	Total			1.00	

Table 10: *List of components of sustainable development for UN Summit 21.*

Issue	Emblem	Feature supported by RBF-NANO	Possible coverage
No poverty	1 NO POVERTY	Poverty can be eradicated by afesaible and adoptable system of food production	*
Zero hunger	2 ZERO HUNGER	The N-RBF will produce every one in system for developinh zero hunger	*
Good Health and well being	3 GOOD HEALTH AND WELL-BEING	Biodiversity and their higher productivity will enabale sufficient food commodities that will result in required feature	*
Quality education	4 QUALITY EDUCATION	After primary need of food gets satisfied, it will prompt people acquire quality education	+
Gender equality	5 GENDER EQUALITY	Food sufficiency will become fostering factor for bringing gender equality	*
Clean water and sanitation	6 CLEAN WATER AND SANITATION	Earlier emphasis remaine on creating such facilities, but now it is oriented towards improvement in quality of service and treatment of solid and liquid wastes wastes.	+
Afforddable and clean energy	7 AFFORDABLE AND CLEAN ENERGY	The N-RBF is formable by affordable energy that will foster clean energy	*

Decent work and economic growth		N-RBF involves nature based processes that induce high productivity and economic growth	*
Industry innovation and infrastructures		High prodicivity of the new food production system will induce innovation and infrasture building	*
Reduced inequalities		Enabling increase in idvidual income will improve eeqality and reduce inequality	*
Sustainable cities and communities		Such developments will follow after fulfilment of basic food needs at individual level	+
Responsive consumption and production		The NRBF developed on ecosystem consideration willb highly responsive in consumption and production	*
Climate action		The N-RBF is proven to have inducrance and resilience to climate change	*
Life below water		There exist plentiful technology for non dispensible water user fishery and shimp. Tankaged water use for irrigation is a componenet in NRBF.	+
Life on earth		N-RBF will foster almost all flora and fauna on surface	*
Peace justice and strong institutions		There are institutions, but need lot of polcy reformations for justice.	+
Partnership for the goal		This aspect is already recognised, it needs some refinements and rectification	*
Total aspect coverage		Total 17 Highly fostering *=12 Supporting +=5	17, *!2, +5 71% 29%

Innovation partnership for sharing prosperity for sustainable development goal of UN 2030

Innovations are created to enhance out puts with respect to given inputs. In agriculture for food and nutrition there occur lot of factors which contribute its output. Previous accomplishments summarized in presents various innovations which bring tremendous magnification of prosperity (Figure 4). An ideal representation of aspects by convergence, its interactive magnification and its divergence for catering need of large no of beneficiaries. In this situation, well known principle of Paritosh law (20:80) will be useful tool in delegation of work responsibility for fostering both convergence as well as divergence in respect of innovation as well as sharing prosperity in UN sustainable development (Table 9). It needs to be emphasized that work can be delegated, but entire responsibility remains with different sectional heads. This is the basic principle of building effective, efficient and ideal organizational setup. Thus, these guidelines will enable quick capture of SDG.

UN sustainable development and applicability of n-RBF for fulfilling various strategies

The study presented nano technology of raised beds and furrow (N-RBF) as best option among already introduced measures for accomplishing SDG of UN Mission. There had been some limitations making the measures not get adopted. The N-RBF got substantively proven as best measure to improve soil and land productivity to many folds. The N-RBF builds tremendous enhancement in yield of wheat as food crop for eliminating hunger and becoming good quality nutrition for improving nutrition sufficiency. The food and nutrition are important strategies of Sustainable development goal. How the enhancement in yield is going to supplement different strategies are elaborated in (Table 10). This research brings the UN food mission to proceed and accomplish desired sustainable development goal. Make it clear that out of total 17 strategies almost 12 strategies get strongly fulfilled making almost 71 % and supporting the remaining 29% of the SDG. Therefore, it deserves high merit in complacent launching project on N –RBF in highly modest way [29].

Discussion

The study established that practice of raised bed and furrow had long history in its genesis, development, utility and efficient as well as limitations that render it not becoming sustainable practice. Ability of the RBF in enhancing yield to cater need of growing populations developed countries viz Australia and United States of America and International organization launched operational demonstration project in South East Asian countries for enhancing cereals and bring crop diversifications. There too the RBF brought enhancement in yield and saving in irrigation water but due to some inherent problems with the RBF rendered it not get adopted and such promising development could not get adopted. Scanty researches with research institutions remained busy only on improving utility and efficiency of RBF. However, the limitations remained un surmounted impeding barrier in adoption. The earlier researches on raised beds and furrows established increase in yield and saving in irrigation water and crop diversification. This research sufficiently established the achievable such benefits by physical facts. Further, fortification of the seven CEC factors were demonstrated in form of practices on the basis of different cycles of plant nutrients. Different examples of research results have been set in the study. Therefore, this research sufficiently is justified for any innovative research [30]. This study brought new direction on innovative justifications for bringing as NRBF as renaissance of the past practice. New aspect was enforcement of CEC as basis for innovations for creating innovations. The CECs get manageably synthesized and fostered hence given N_RBF meaning nano tech supported RBF All limitations got removed and the practice N-RBF made plausibly adopted. The innovations are enhancing the CEC factors viz N,S,O,C, Cl, I and humification, which get to revamp the N-RBF. Other innovations viz sorptivity, eco-zero weeding super micro irrigation to overcome weed problem, elimination of compaction were applied. In addition to the soil CEC factors there are also highly important and influential factors brought as nanotech to become supporting component as integrated practice as new innovation. These are sorptivity, eco-zero weeding, super micro irrigation and N cycle management based cropping pattern. The size of the RBF is fixed to be formed by general purpose tractor with track width of 1.8m. Field experiments on sorptivity, N fixation, P solubilization and irrigation effectively established efficiency of these factors which bring confidence in researcher and user of the N-RBF. The results on enhanced crop harvest in comparison to different scenarios that could exit different fields built CEC confirming scenario produced results depicting yield enhancement and scope of elevating efficiency of CEC factors. The factor sorptivity showed that delay in sowing can get compensated by one week, and seed no filling got compensated to normal date sown crop [31]. Thus, these researches showed very high possibility of enhancing crop yield and building compensating measures. His study developed a Nano technology by converging all aspects of CEC elemental involvement for enhancing productivity of soil to surpass limitations in past, which made its no adoption by the users. The scientific issue involvement and sufficient experimentation make the N-RBF highly effective and adoptable. Further, ratification of the research in support of results and derivation of conclusions are presented in the following. Soil masses constitute anions and cations. The cations attract anions to form plant nutrition compounds ready to be absorbed by root hairs and produce growth and yields. The elements and involvement of their ions form nano particle and development of practice by convergence of all CEC elements and converted in form of N-RBF is true and strong nano technology practice. The cations are N, S, O, C, I, clay and humification, only seven cations chartering enhancement of productivity of soil against 15 anions. Thus, this study established complete coverage of possible enhancement in productivity of soil although cation exchange capacity maneuvers. Thus, this research is sufficiently strengthened to serve as nano technology with full justification. Further, research will inspire researchers to conduct on soil productivity to create general awareness and confidence leading to its adoption. Earlier researches right from genesis of RBF, getting transformed to permanent raised bed and furrow (PRBF) had been conducting on efficacy and enhancement in productivity for almost seven decades on field experiments and publishing their researches, writing books for popularization of the RBF or PRBF and getting name and fame, as well as creating base for young researchers understanding prospects of soil productivity [32]. However the researches could not get widely adopted and all scientific efforts appeared leaving ground [33-35]. Researches in recent decades also continued the same, without any additional scientific vision, but extending application of RBF for crop diversification. Some researches had moved to laser leveling in lieu of the RBF or even laser leveling of raised beds and ariving to same conclusion of irrigation water saving and enhancement in productivity as well as crop diversification. The laser leveling sounds high brings increase in uniformity of application water, which accomplished moisture supply or to some extent humification, which are only one or two aspects of CEC factors. Thus, Laser land leveling is not a measure to enhance CEC in completeness; hence it cannot be regarded as better than the N-RBF. Thus, it is sufficiently established that the RBF or even PRBF are effective practices of soil productivities, as established by the past researches. At the same time it also got established that the science of RBF did not perceive utility of CEC, which is nano base in enhancing soil productivity. This present study did bring new innovations on utility of CEC and full justification to get N-RBF adopted as Nano Tech practice. The associating advancing researches were arrived with theory and field experimental research proven facts. Thus, the present study took the soil science to new acme, proving superior to laser leveling and bringing still better results on productivity and saving of irrigation water. The present research presented an integrated scenario covering different aspects of nano technology. Such integrated attempt showed that benefits can be harnessed proportional to coverage of CEC factors. It also enabled isolation of weak practice at any site, which can be optimized to produce desired level of output. This proves to be highly desirable scientific approach. The study enable establish relative importance of six seven CEC factor in enhancing crop yield. These factors have been getting supplemented in or other ways, which might not be sufficient. The present study make CEC and their effective role clear and the components which can be revamped by innovative practice to bring high yield, nutrition content, and sustainability under changing climate. As established in result section of the study it includes plentiful innovations made on different nutrient building CEC factors. The most comprehensive and advanced is N cycle management practices bring many fold enhancement in yield and elimination of drudgery in agriculture. and Research on S is again important advancement. The N-RBF deals with O2 that implicates suitability and resilience under the changing climate bringing sufficiency of food and nutrition. Research emphasis on C, Clay and humifications are highly convincing results opening scope of nutrient management in agriculture [36-38]. Thus, the present research makes refinements in the basic approach and understanding management of nutrient in soil-water plant relation implicating agriculture and food. The innovative N-RBF is a practice different from existing known or ongoing practices in world over agriculture. This innovative research emerged after attention for solving variety of problems and non adoption by the users. The N RBF is armed with different innovations to be successful and productive under all situations. Analysis established that N-RBF is enabled to directly bring sustainable development by 71 % and in remaining 29 % cases it brings good support for the mission. Thus, N-RBF is a single button to create sun light on sustainable development goal of U.N. Mission. There had been different approaches on fulfilling the set objectives, but not in perfection [39-55]. This research becomes a path setter for the mission The U.N Mission Official document indicated that there were abundance of examples from communities, farmers' organizations, companies, indigenous leaders and individuals already charting the course toward positive change expected from the team. There had been Global partnerships and leaders from all areas stepping up to support the transformation of food systems harness the best ideas and practices from around the world to help lead the way. In this stride N-RBF is ready perfect answer facilitating accomplishment of sustainable development goal.

Conclusion

The present study led to following meaningful conclusions of esteem values Study made review to substantiate the practice on RBF and PRBF (which is the main subject of the study), had proven effective in enhancing crop yields and water use efficiency with saving in irrigation water. Past researches provided tremendous opportunities for learning and understanding innovative method of raised bed and furrow (RBF/PRBF) right from genesis to its existence. As at present. II Past practice proved effective, but there occurred some limitations which led to no adoption by users and agriculture practiceners. The main limitation was non availability of RBF forming implements. Many researchers attempted on finding suitable sizes of RBF, particularly width of raised beds. III In the present study a new strategy of improving the CEC factors and their other supporting measures were adopted. A N- RBF was devised for its dimension and formable by general purpose tractor having track width of 1.8m. Field experimental results revealed prosperous growth and yield in contrast with yields from different CEC scenarios. This study established relative importance of CEC factors that contribute to increase yield. Nitrogen is the most prominent factor which could be researched to develop innovative cropping patterns to enhance yield by many folds. The CEC factors S and I enhance yield and nutritional quality of food crop commodity. Thus, N-RBF a nano technology will get fast adopted to produce tremendous quantity of Food with nutrient content. The N- RBF is highly suitable innovative technology to be adopted as directly contributing almost 71 % and supporting remaining 29 % of issues of SDG of the United Nations. This CEC based innovations are highly indigenously manageable and applicable in word agriculture as soil is basic resource that supports development of sustainable agriculture.

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Declaration of No Conflict of Interest

It is declared that there existed no conflict of any kind or any interest, what so ever may be.

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