SOIL REJUVENATION BY NATUECO SCIENCE : A BOON TO CROP AND ANIMAL HUSBANDRY.

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ABSTRACT

An on farm trial on Natueco-Science (recently developed system of crop husbandry) was carried out for six years . In this study it was found that in the *Amrut Mitti ie. fertile live soil*. the available forms of all major elements and micronutrients increased many folds. Also record yield of various crops were obtained. The proximate composition of bottle gourd showed that protein and calcium increased significantly and also Vitamin B12 was recorded at the level of 3 mg /100g which was found in BDL market sample of bottle gourd. Further 5 mg /100g Vitamin B12 in Drumstick was recorded.

KEYWORDS : Amurt Jal, Amrut Mitti Fertile live soil., Soil rejuvenation, Natueco Science, Available nutrients

I**NTRODUCTION** : During 1840-1900, the use of artificial fertilizers became a necessary part of agriculture throughout the world. Importance of Nitrogen(N), Phosphorus (P),and Potash (K) in the soil was firmly established . Liebig's work formed the basis of mineral approach to crop nutrition which resulted in the use of chemical fertilizers and mega growth of fertilizer industries. Whole credit of Modern chemical farming goes to Liebig only. Liebig's principle of chemical farming can be compared with discovery of nuclear power and its possible misuse and now a days whole world is terrorized of nuclear misuse.

Ecological disasters by intensive agricultural and animal rearing practices prompted many scientists in 20th century (Dr. John Augustus Voelcker, Mollison, Alexander Walker, George Washington Karwar, Rudolf Steiner, Sir Alber Howard, Robert Rodale, Bill Mollison, Masanobu Fukuoka, S.A.Dabholkar), philosophers, philanthropists and organizations in India and western countries to rethink and find out sustainable alternative production system. Similarly,Organic animal husbandry or organic livestock farming is a system of livestock production that promotes the use of organic and biodegradable inputs from the ecosystem in terms of animal nutrition, animal's health, animal housing and breeding. It deliberately avoids use of synthetic inputs such as drugs, feed additives and genetically engineered breeding inputs, while ensuring the welfare of animals. Organic farming is based on closed agricultural systems and minimal use of non-renewable energy sources (Chander & Subrahmanyeswari, 2013). All thinkers unanimously predicted that the plant nutrition theory of Liebig was harmful, but still the farmers are not coming out of the phobia of decreasing productivity by not using chemical fertilizer , however on the other hand, it is also a fact that day by day not only productivity of the soil is drastically decreasing even after using huge quantity of chemical fertilizers and pesticides but also soil is degrading badly alaongside threat to human life in many different ways .

S.A.Dabholkar (1998) in India developed the concept of natural farming which is called Natueco-Culture or Science. With Natueco-culture one can intelligently and efficiently collaborate with nature in pumping out entropy and building abundance through harvesting , conserving and using daily available solar isolation reaching our planet. It depends upon critical understanding of greening and recycling of biomass from within to enrich the structure and fertility of soil in a calculated way. The basic fundamental principle of Natueco Science is to harvest solar energy, which is dependent on canopy of the plant and a good canopy can be obtained only from a good fertile live soil which

is now called as Amrut Mitti. Following and adopting the principles of Natueo-Science we have conducted a study at Krushi Teerth , Bajwada of District Dewas (M.P.) since 2006.

MATERIALS AND METHODS

In any farming operation first thing to be taken care of is **Soil,** as it supports the growth of the plant by providing it nutrients and water whenever required. The essential component of NATUECO Farming is a special kind of soil called ***Amrut Mitti*** or fertile live soil which is prepared with biomass, sand and top soil of the farm using *Amrut Jal* .

PREPARATION OF AMRUT MITTI : It involves two steps (1) preparation of *Amrut Jal* and (2) *Amrut Mitti* (fertile live soil).

Amrut Jal (Innovative Bioculture) :

Amrut Jal is a solution of water, jaggery, cow dung and cow urine containing a very high number and diversity of hermetic micro-organisms. The chemical elements present in *Amrut jal* make the soil fertile and the micro-organisms increase the chemical transformation of unavailable form of elements into available form.

Amrut Jal is basically a fermented solution of cow urine, jaggery and cow dung in water.

(I)Make a fine paste of 1 liter cow urine and 1kg fresh cow dung in a tub. (II) Add 50 gm paste of Jaggery to it and mix properly. (III) Transfer the mixture to a bucket containing 10 liter of water. (IV) Stir the mixture 12 times clockwise and 12 times anti-clockwise. (V) Cover the bucket and stir thrice a day as in step IV . (VI) After 3 days i.e. 4th day transfer the mixture to tank containing 100 liter water and mix well. This preparation is called *Amrut Jal* and can now be used the same day for better results with high microbial count.

Amrut Mitti (Fertile Live Soil)

Amrut Mitti is a special type of Mitti which is prepared by decomposition of dry biomass in soil and sand which contains all the essential elements and is favorable for the plant growth and development. It consists of 50 % of biomass and 50 % of activated mineral top soil (V/V). It takes nearly 140-150 days for the formation of *Amrut Mitti*. The process of making of *Amrut Mitti* takes place in following steps :

Heap making

(I) Prepare a 10 ft. X 3 ft. area on plain land. (II) Make a thin layer of chopped (3-4 inches) dry biomass soaked in *Amrut Jal* for 24 hrs.(III) Put thin layer of topsoil on top of the soaked biomass layer in ratio of ¼ mass of biomass. (IV) Repeat steps 2 and 3, after every 6 layers of both, add a layer of sand (Sand layer can be skipped depending on sand content of the soil used. It is only needed when the soil is clayey and compact. (V) Compress the heap by walking/dancing on the heap (adding our vital energy to the soil). (VI) Repeat the steps 2 to 5 till the height of heap reaches 1 ft. (VII) Cover the heap with mulching. (VIII) Turn the heap once every 7 days to mix the mixture properly and to fasten the process of decomposition uniformly. (IX) After 30 days cover the heap with 2 inches of soil.

Seed sowing (Greening of the Heap)

(I) Soak six different types of seeds in *Amrut Jal* for 4 hours . (shad rasa: Shad rasa are sweet (Fennel seeds), pungent (chilies), bitter (Fenugreek, bitter gourd), tangy (Tomato, Ambadi), acerbic (Guarphali) and salty (Spinach, cow urine). (II) Spread the seeds @ 10 gm./sq. ft., press them with soft hands. Any other plants which give the different rasa can be used. (III) Spread soil above seeds about double the size of seed. (IV) Sprinkle *Amrut Jal* over it. (V) Cover with biomass dipped in Amrut Jal (mulch). (VI) Keep the surface moist by sprinkling *Amrut Jal* at regular intervals

Pruning and heap turning

(i)Remove the mulch when the seeds germinate. (ii)On 21st day after germination, prune the plants 25% without damaging the stem and leave the residue on the heap. (iii)On 42nd day after germination, prune the plants another 25% and leave it on the heap. (iv)On 63rd day after germination, prune the plants completely leaving 0.5-1 inch above ground. (v)When the biomass on heap turns yellow, soak it in Amrut Jal for 4 hours and spread on heap and keep turning once in a week for one month. *Amrut Mitti* will be completely ready in 140-150 days. The process may be faster in rainy season.

TRIAL ON 2 ACRE LAND

For preparing *Amrut Mitti* we sow Maize, Dhaincha and Mustard in the whole 2 Acre area and then after 63 days cut it green, made it dry, chop it in the size of 3-4 inches and then start preparing the *Amrut Mitti* heap. This way we prepared 262 heaps which are sufficient to cover 0.87 acre of land. This area now can be used for the normal Natueco crop production which will yield almost 4 times of the normally grown crops. The higher yield on *Amrut Mitti* will compensate for the loss of one crop during production of bio-mass for *Amrut Mitti*. For remaining 1.13 Acre of Land , repeat the process again and this time 279 heaps prepared and after that additional 0.93 Acre of land converted into *Amrut Mitti*. Remaining 0.2 Acre of land can be converted into Amrut Mitti with the dry biomass of the existing crop on the farm. By this way in three rounds we have converted the whole 2 Acre cultivable plot into the *Amrut Mitti* without using anything from outside the farm except seeds , which can be returned back by growing seeds on 1/8th of the plot.

What should be done to keep the Amrut Mitti fertile

After taking out the yield produced in this soil, all the left over biomass should be used as a cover for the *Amrut Mitti* , after every three months ash should be mixed in the Amrut Mitti at the rate of 30 grams in every square foot. *Amrut Mitti* should always be kept covered with live mulching or dry cover. If there is lack of water, then a heap of *Amrut Mitti* should be made in the shade and kept covered with dry grass, polythene, paper or stones, so that water evaporation minimized.

SOIL ANALYSIS

Soil samples of the Krushi Teerth farm and Nisarg farm Sayne, Malegaon Distt. Nashik , (Maharashtra) were sent to ICRISAT , Patancheru (A.P.) for analysis . The soil samples were collected from the original soil ie. Without treatment , between the heap , planted heap and below the heap and proximate analysis of bottle gourd obtained from Market and from Nisarg farm was carried out by Ashwamedh Engineers and Cosultant ,Laboratory service division , Nashik following AOAC (2010) methods.

Table 1. Available P, total P, Kjehldanl N, exchanglable K (ppm) and % organic carbon in the soil samples collected from Krishi Tirth, Bajwada, Dewas (MP).

Treatment	Available P (ppm), % of total	Total P (ppm), % of total	Kjehldahl (organic form) N (ppm)	Exchangable (available) K (ppm)	%OC (ppm)	pH
Original Soil	17.1 (4.4)	392	174	284	0.66	7.75
Between Heaps	20.5 (5.7)	362	198	315	0.74	7.59
Planted Heap	33.1 (8.1)	410	194	424	0.72	7.91
Below heap	247.7 (49.5)	500	798	770	2.61	7.89

RESULTS AND DISCUSSION

The results of soil analysis of the present experimental field are presented in tables 1-3 . The data indicate a system of crop husbandry that uses locally available natural resource , knowledge and labor to convert a soil with low to high available form of crop nutrient.

A plant needs over 30 different elements for its growth/formation of leaves, stem and fruits . In the present trial experiment three major elements nitrogen (N), phosphorus (P) and potash (K) and ten micro elements [B (boron), Ca (calcium), Mg (magnesium), S (sulphur), Fe (iron), Mn (manganese) , Mo (molybdenum), Cu (copper), Zn (zinc) and Cl (chloride)] were measured in total and available form. All the 30 elements occur in a soil largely in two forms – 'available' and 'non-available' form. The available form of a nutrient can be readily taken-up by a plant through its roots while the unavailable form of elements are converted into available form through microbial enzymatic activities or through production of organic acids.

Perusal of table 1 revealed that there was non significant changes in total phosphorus whereas a highly significant ((p<0.001)) increase in available phospohorus and more than 3.5 fold increase in soil organic carbon per cent was recorded. Similarly more than 5 and 7 fold (5.81% and 7.89 % SOC) increase in SOC as compared to original soil (0.66%) was recorded from Amrut mitti of Nisarg farm Nashik . Organic Nitrogen and available potassium increased significantly at (p<0.01)and (p<0.05)level ,pH of *Amrut mitti* was higher (7.89) as compared to other samples . Fertility of the original soil was lower than that of the area under cultivation; it was maximum below (15 cm) the heap indicating that roots from plants sown on heaps will tend to go deep in the soil to explore/take-up the nutrients . A review of the available comparative studies in the report of soil carbon and organic farming (2009)indicate that organic farming produce 28% higher soil organic carbon level than non organic farming in Northern Europe and 20 % for all countries studied (Europe, North America and Australia) whereas in the present study we obtained many times higher SOC as compared to the reported value from organic farming in North Europe and thus soil rejuvenation as per Natueco-culture methodology may solve the burning problem of soil degradation and in turn decreasing soil productivity throughout the world. Increasing soil organic carbon (SOC) can improve soil health and can help to mitigate climate change.

Soil organic carbon is important for all three aspects of soil fertility, namely chemical, physical and biological fertility. Soil Organic Carbon (SOC) is the main source of energy for soil microorganisms, which causes decomposition of soil organic matter and releases nitrogen, phosphorus and a range

Table 2. Total B, S, Fe, Zn (ppm), and Available B, S, Fe, Zn and Mo (ppm), in the soil samples collected from Bajwada (MP), sampled on 19.09.07.

Treatment	Total B (ppm)	Ava B (ppm); % of total	Total S (ppm)	Ava S (ppm); % of total	Total Fe (ppm)	Ava Fe (ppm); % of total	Total Zn (ppm)	Ava Zn (DTPA-Zn); % of total	Ava Mo (ppm)
Original Soil	29.7	0.27 (	93	7.17	40442	15.6	133	0.83	0.019
Between Heap	26.0	0.29	103	7.00	33550	11.7	108	1.08	0.009
Planted Heap	27.0	0.32	94	7.60	34625	9.1	77	0.97	0.012
Below heap	26.7	2.29	420	18.93	33300	21.0	97	6.10	0.020

* Ava = Available

of other nutrients for plant growth and act as trigger for nutrient availability through mineralization.

An increase in SOM, and therefore total C, leads to greater biological diversity in the soil, thus increasing biological control of plant diseases and pests.

Available form of nutrients (B, S, Fe, Mo and Zn) were invariably significantly more below the heap than that at other sampling spots of the same field . Total concentration of all these elements was similar across sampling spots except for 'total S' (Table 2). It was apparent that the heap method of cultivation has ability to continuously converting insoluble form of nutrients to soluble form .

Microbial C and N biomass and dehydrogenase activity were increased below heap as compared to the original soil (ie. Without any treatment) which indicate that the soil below heaps had most microbial activity/population followed by that in the original soil while the activity in the decomposing biomass in heaps was highest . Activity of microorganisms as indicated by 'dehydrogenase' enzyme was also maximum in the sample collected below the heaps, followed by that in the heap itself, and lowest activity was noted in unplanted area between heaps which was covered with dry biomass. (Table 3).

Table 3. Biomass carbon, biomass nitrogen and dehydrogenase activity in the soil samples collected from Krishi Tirth, Bajwada, Dewas (MP)

Treatment	Microbial Biomass **C** (mg kg^{-1} soil)	Microbial Biomass **N** (mg kg^{-1} soil)	Dehydrogenase activity (µg TPF $g^{-1}24\ h^{-1}$)
Original Soil	376	37	58
Between Heap	274	33	38
Planted Heap	208	34	63
Below heap	426	66	98

NS= Differences across treatments are statistically non-significant

Biochemical constituents of Bottle Gourd :

Quantitative estimation of biochemical constituents of bottle gourd revealed that protein content was found to be 5 fold more in bottle gourd grown on *Amrut Mitti* (7.81 g/100g)as compared to bottle guard obtained from market sample (1.44 g/100g), like wise an increase in calcium was also noted by 40 % . Magnesium (5.18mg/100g) and Iron (0939 mg/100g) was also recorded in Nisarg sample ,however no estimation was carried out in market sample hence no comparison can be made . Vitamin B12 was 3 mg /100g in Bottle gourd and 5 mg/100 of Drumstick as compared to market sample in which Vit B12 was not detectable. Further from the Natueco farms record yields of Rice, Wheat, soyabean and ground nut ,40,30,20 and 24 quintals per acre respectively was obtained.

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