Impact of ICT on the Yields of Crops Grown in Northern Karnataka

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ABSTRACT

The mobility and availability of soil nutrients to the crops depends on the moisture content and nature of the soil. Drought conditions leads to boron deficiency which manifests bud necrosis in greengram and sunflower. Whereas excess rainfall or irrigation during the crop growth, leaches out nitrogen, calcium, boron and other nutrients which retards the yields through pests and diseases. To mitigate the problems, field demonstrations were conducted by supplementing the specific nutrients with need based training in farmers fields for a period of two years (2009-2010). The results on, greengram and sunflower indicated that the crops yields were increased to the application of secondary and micronutrients to the extent of 47.0 and 25.3 per cent respectively over farmers practice, in dry land eco-system. Whereas, in irrigated conditions the yields of Cotton increased to the extent of 19.1 per cent over farmers practice.

***Key words**: Soil moisture, secondary nutrients, micronutrients demonstration.*

Intensive cultivation without replenishment exhausts the soil fertility thereby production will not be sustained. *Fairthrust (2003)* also describes the downward spiral in to the poverty trip through the progressive process of nutrient depletion, yield reduction, income loss and finally soil degradation. A comprehensive study by *Sillappa (1982)* observed that micronutrient deficiencies were common in many parts of Asia-Pacific region and most recently by Srinivasa *Rao et al (2007)* in the semi-arid areas of central India. Lammel (2005) comprised that a short fall of specific nutrients is still the major reason with limited water supply for low crop yields and poor quality throughout "world Agriculture". To improve the nutrient content/density of crops and their contribution to the human and animal diets, can be achieved by appropriate balanced micronutrient fertilizer inputs (*Graham and Welch , 2007*). Very recently *Elser et al (2007)* postulated that alleviation of one nutrient limitation produces a synergistic, rather than a simple additive effect, when another nutrient limiting is introduced in the system. *Baker and Amacher (1981)* defined normal values for the exchangeable cations as 60 to 80% for Ca, 10 to 20% for Mg, and 2 to 5% for K. The major factor, contributing to declining crop responses (17.9-6.3) over a period of 1960-2000, being continuous nutrient mining and imbalanced nutrient use, leading to depletion of secondary and micronutrients like, P, K, Zn, Mn, Fe & B from the soil (*Satyanarayana and Tweatia 2009*).

Micronutrient deficiencies like Zn (72.8 %), Cu (5 %), Fe (35%), Mn (17%), and B (32%) were observed in soils of Karnataka. The availability of micronutrients in the soil are limited with higher pH and specially Ca and B are highly immobile in the plants which causes reduction the vital enzyme activities and in cell division of the youngest leaves which leads to necrosis. With this view, and based on the field exposure as a soil scientist, I assessed the root cause, and with the soil test valves, treatments were tailor made by involving both secondary and micronutrients, to alleviate the short comings with the existing recommendations. Demonstrations were conducted by supplementing the inputs and need based trainings at the required time, were imparted in different villages.

METHODOLOGY

The collected soil samples were analysed for pH, Ec, organic carbon, per cent available P2O5, K2O, and exchangeable Ca and Mg by the procedure of Jackson (1973) and results are tabulated in table 1. Treatment consists of RDF+ Samruddi @ 125 kg/ha (Ca+Mg +S), as soil application and cow urine spray @50 ml /l of

water once, and Micronutrients(combined) spray @ 20ml/l, twice, compared with the farmers practice.

RESULTS AND DISCUSSION

The average pH of the soil recorded was 7.9 (Table 1), indicated that the soil reaction being high which hinders the uptake of micronutrients, thereby the deficiency of them prevailed. Whereas Ec is below the critical level not harmful to the crops.

Table 1. Nutrients status of the UKP soils

Farmer Sample No	pH 01:02.5	Ec ds/m	Ca + Mg me/100g	K_2O kg/ha	P_2O_5 kg/ha	O.C%
1	7.99	0.28	28.25	743.3	55.57	0.51
2	7.65	0.24	23	718.2	34.2	0.52
3	7.86	0.43	25	882	32.37	0.46
4	7.69	1.27	25.5	478.8	12.21	0.38
5	8.02	0.17	20.5	327.6	25.65	0.44
6	8.1	0.3	37.5	567	28.7	0.58
7	7.92	0.29	65	878	15.27	0.52
8	7.94	0.4	26.25	365.4	14.05	0.61
9	7.47	0.25	12.5	289.8	19.54	0.44
10	7.74	0.23	25	756	42.75	0.7
11	7.97	0.3	15	403.2	12.82	0.44
12	8.1	0.24	62.5	869.4	21.98	0.44
13	8.12	0.33	61.25	907.2	12.82	0.73
14	7.6	0.27	18	554.4	23.82	0.56
15	7.71	0.25	14.5	277.2	17.1	0.31
16	8.22	0.71	51.25	856.8	10.38	0.42
17	7.22	0.27	13.75	289.8	9.77	0.58
18	7.56	0.18	8.75	252	14.05	0.55
19	7.88	0.25	17.5	428.4	61.68	0.52
20	7.63	0.3	7.5	176.4	29.31	0.41
21	7.78	0.29	15	579.6	62.29	0.61
22	8.28	0.87	53.5	909	12.82	0.57
23	7.9	0.85	45.2	475	21.97	0.6
24	7.78	0.29	25.6	386	32	0.3
25	7.75	0.25	38.5	512	40.91	0.55
26	7.92	0.29	43.2	610	9.77	0.55
27	7.2	0.6	26.1	457	43.8	0.51
28	7.8	0.54	23.6	389	38.1	0.6
29	7.4	0.29	18.5	428	40.2	0.53
30	7.9	0.35	52.1	647	32.6	0.48
31	7.3	0.62	44.2	543	28.6	0.41
32	7.8	0.36	60.5	751	47.2	0.62
33	7.7	0.72	61	788	26.5	0.45
34	7.7	0.69	59	696	29.3	0.39
35	7.8	0.37	19.7	401	18.3	0.54
36	8.1	0.32	56	594	22.1	0.31
37	8	0.81	50.8	724	35.1	0.44
38	7.6	0.55	42.3	492	16.2	0.36

Organic carbon content varies from 0.30 to 0.7% , out of which 45 per cent were comes under low, 50 per cent medium and 5 percent were high, which reveals that incorporation of crop residues or green manures were necessary to maintain status of the soil organic carbon. To achieve an increase of soil organic matter, additions must be higher than removals. Over a given year, under average conditions, 60 to 70 percent of the carbon contained in organic residues added to soil is lost as carbon dioxide.

The soil phosphorus content varies from 9.77 to 61.88 kg/ha, out of which 26 per cent soils were under low, 45 per cent were in medium in range and 29 per cent soils were high. Only 26 percent of the soils require proper P management strategies.

The highest potassium content in the soil was 907.2 kg /ha and lowest recorded was 176.4 kg/ha. This may be attributed to the clay and mineral content of the soil.

The exchangeable Ca+Mg, of the soil analysed was low, to the extent of 55 percent, which require the application of Dolomite or Calcium and Magnesium containg fertilizers to maintain the optimum base saturation of the soil. Baker and Amacher(1981) redefined the ideal ratio as 60-80% Ca, 10-20% Mg, 2-5% K.

Table 2a. Percentage of nutrient uptake through roots accounted for by interceptive root growth, mass flow and diffusion (Dennis, 1971)

Plant nutrients	Approximate parentage nutrient uptake through		
	Interceptive root growth	Mass flow	Diffusion
N	2	98	-
P	3	6	91
K	2	20	78
Ca	28	72	-
Mg	13	87	-
S	5	95	-
B	3	65	32
Cu	70	20	10
Fe	50	10	40
Mn	15	5	80
Mo	5	95	-
Zn	30	30	40

Table 2b. Nutrient removal from the crops (Kg/ha)

Crops	Particular	N	P_2O_5	K_2O	S	Ca	Mg
Cotton	Lint	105	40	45	7	18	12
1500	Residue	95	30	85	25	9	12
lb	Total	200	70	130	32	27	24
Peanut	Nuts	175	33	41	13	12	17
5000	Residue	95	30	85	25	90	24
lb	Total	270	63	126	38	102	41

The review work of Dennis (1971) mentioned in (Table 2a) indicated that the nutrient uptake of nitrogen (98%), calcium (72%), magnesium (87%), sulphur (95%), boron (65%) and zinc (30%) were by mass flow which is influenced by the water movement. The excess irrigation or rainfall will take away the above nutrients through leaching thereby yields will be reduced drastically with the excess of it. On the other hand crop residues removes higher quantities of nutrients (Table 2b) from the soil which creates nutrient stress if those removed nutrients are not being replenished as revealed by (Fairthrust (2003). The total nutrient loss may be accounted ,for the above facts mentioned and constant monitoring and replenishment are necessary for sustainability.

Yield:

The results of table 3 indicated the cotton yield, increased about 19.1 per cent of the demonstrations (28.2 q/ha) over farmers practice (23.8 q/ ha), which was highly correlated (0.9). This is attributed to the supplement of secondary nutrients through Samruddi which raised the base saturation of the soils as elucidated by Baker and Amacher (1981) and spray of cow urine supplemented the secondary micronutrients and anti oxidants required for the growth of crops. This is in accordance with the work of Gadelha *et al* (2008) in pine apple. The spray of micronutrients alleviated the deficiencies prevailed at high pH reported by Lammel (2005), and he was of the opinion that short fall of specific nutrients is still the major reason with limited water supply for low crop yields.

The necrosis in sunflower and green gram has been associated with the deficiencies of Calcium and Boron due to their immobile nature in the plant system and also due to the lower

Table 3. Effect of application of nutrients on yield and B:C ratio and their correlation coefficient

Farmer	Bt Cotton				Sunflower				Greengram					Bt Cotton				Sunflower				Greengram			
Sample No (FS no)	Treat Yld q/ha	FP Yld q/ha	% in Yld	B:C	Treat Yld q/ha	FP Yld q/ha	% in Yld	B: C	Treat Yld q/ha	FP Yld q/ha	% in Yld	B:C	FS no	Treat Yld q/ha	FP Yld q/ha	% in Yld	B:C	Treat Yld q/ha	FP Yld q/ha	% in Yld	B:C	Treat Yld q/ha	FP Yld q/ha	% in Yld	B:C
1	30	25	20.0	10	12.5	10	25.0	6	7.5	5	50.0	6	20	28	24	16.7	8	12.7	10.25	23.9	5.6	6.9	4.8	43.8	6.3
2	24	21	14.3	6	13	10.4	25.0	6	7	4.8	45.8	6.6	21	27	23	17.4	8	16	13.75	16.4	6.3	7.7	5.4	42.6	6.9
3	21	17	23.5	8	12	9.5	26.3	7	8	5.2	53.8	8.4	22	32	28	14.3	8	16.25	13.75	18.2	6.9	7.3	5.2	40.4	6.3
4	22	17.5	25.7	9	13.5	10.5	28.6	8	7.8	5.1	52.9	8.1	23	26	21	23.8	10	15.25	12.25	24.5	7.5	7.6	5.3	43.4	6.9
5	23	18	27.8	10	14	11	27.3	8	7.6	5.1	49.0	7.5	24	27	24	12.5	6	10.5	7.5	40.0	7.5	6.5	4.3	51.2	6.6
6	26	21	23.8	10	12.8	10.2	25.5	7	8.2	5.5	49.1	8.1	25	35	30	16.7	10	11	8.5	29.4	6.3	8.4	5.8	44.8	7.8
7	25	21.5	16.3	7	14.3	11.25	26.7	8	8.1	5.5	47.3	9	26	30	25	20.0	10	9.75	7	39.3	6.9	8	5.7	40.4	6.9
8	26	22	18.2	8	11.5	9	27.8	6	7.9	5.2	51.9	8.1	27	29	24	20.8	10	10	7.5	33.3	6.3	8.6	6	43.3	7.8
9	24	20	20.0	8	12	9.6	25.0	6	7.4	5	48.0	7.2	28	28	23	21.7	10	11.75	9	30.6	6.9	6.6	4.2	57.1	7.2
10	28	24	16.7	8	11	8.8	25.0	6	6.9	4.7	46.8	6.6	29	26	22	18.2	8	13.5	11	22.7	6.3	7.5	5.1	47.1	7.2
11	32	27	18.5	10	11.8	9.25	27.0	7	6.5	4.5	44.4	6	30	28	24	16.7	8	14.25	11.5	23.9	6.9	7.2	4.9	46.9	6.9
12	30	26	15.4	8	12.3	10	22.5	6	7.6	5.3	43.4	6.9	31	30	25	20.0	10	15.25	12.5	22.0	6.9	7.7	5.4	42.6	6.3
13	27	23	17.4	8	12.8	10.5	21.4	6	7.7	5.4	42.6	6.9	32	26	20	30.0	12	15.5	12.55	23.5	7	6.5	4	62.5	7.5
14	33	29	13.8	8	14.5	12.25	18.4	6	8.3	5.6	48.2	8.1	33	32	28	14.3	8	12	9.75	23.1	5.6	8.2	6	36.7	6.6
15	30	20	50.0	8	13.8	11.75	17.0	5	8.1	5.6	44.6	7.5	34	30	26	15.4	8	11.75	8.75	34.3	7.5	7.4	4.9	51.0	7.5
16	29	25	16.0	8	15	12.5	20.0	6	7.3	5.1	43.1	6.6	35	30	25	20.0	10	14	11.25	24.4	6.9	8.3	6	38.3	6.9
17	28	24	16.7	8	15.5	12.25	26.5	8	7.8	5.3	47.2	7.5	36	31	27	14.8	8	12.75	10.75	18.6	6.3	8	5.3	50.9	6.3
18	30	26	15.4	8	14	11	27.3	6	7.7	4.7	63.8	6.9	37	30	26	15.4	8	13	10.8	20.4	5.5	7.2	5.2	38.5	6.3
19	29	25	16.0	8	13.5	10.25	31.7	6	6.4	4.2	52.4	6.6	38	29	26	11.5	6	13.5	11.5	17.4	5.6	7.5	5.3	41.5	6.6
Average														**28.2**	**23.8**	**19.1**	**8.5**	**13.1**	**10.5**	**25.3**	**6.5**	**7.6**	**5.1**	**47.0**	**7.1**
Correlation coefficient between Treatment plot yield and Farmers practice plot														**0.9**				**0.98**				**0.92**			
Correlation coefficient between Per cent increase in yield and B: C ratio														**0.4**				**0.51**				**0.32**			

exchangeable Ca content of the soil. That apart the deficiency of boron prevailed in drought condition which is complimentary to calcium utilization. The deficiency of these causes the necrosis both in sunflower and green gram. The increased yield of 47% being recorded with correlation coefficient of 0.92 over farmers practice in green gram with the supplements, similar demonstration results were recorded by *Upperi et al (2007).*

The increased in yield of sunflower (13.1 q/ha) over farmer's practice (10.5 q/ha), correlated significantly (0.98), attributed to the beneficial effect of supply of secondary nutrients, cow urine and micronutrients spray, similar findings were reported by *Raghu (2011),* where the highest yield of 1392 kg/ha and lowest per cent necrosis (1.85) were recorded with the application of Samruddi and spray of cow urine and micronutrients over only RDF.

CONCLUSION

The large number of demonstration results of dry land as well as irrigated crops responded to the application of secondary and micronutrients which were removed by the intensification of land over the years resulted in stagnated yields with reduced qualities of the foods, deteriorated the health of the human beings and environment.

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