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Influence of Soil Moisture Regimes and N Levels on the Progressive Changes in the Content and Uptake of N By Ragi.

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The influence of soil moisture regimes and doses of added N on the content and uptake of N by finger millet *(Eleusine Coracana* Gaertn.) was investigated in red and black soils of Tamil Nadu. N content of plants was higher under lower soil moisture regimes and under increased rates of N application. N content of grain was more susceptible for soil moisture variations. Higher soil moisture regimes and increased rates of N application increased the uptake of N.

Moisture potential of the soil plays a significant role in influencing the qualitative as well as quantitative traits of crop produce. Nitrogen, the growth element influences the growth, yield and nutrient uptake by the crop. Hence, to investigate the influence of soil moisture regimes and N levels on the content and uptake of N by ragi crop, pot and field experiments were conducted at Tamil Nadu Agricultural University, Coimbatore with ragi variety Co. 10 as test crop.

MATERIAL AND METHODS

Two pot experiments and field investigation were conducted during 1974-75. The experimental soils were neutral in pH. The available N content of red and black soils were 70 and 89 ppm respectively while experimental soils in experiments II and III contained 72 ppm of initial available N.

Experiment I. A pot experiment was conducted under glass house conditions with red and black soils. The treatments consisted of four levels of N viz., O (N_0), 45 (N_1), 90 (N_2) and 135 (N) kg/N/ha as ammonium sulphate with a constant dose of 45 kg/ha each of P_2O_5 and K_2O as super phosphate and muriate of potash respectively. The five levels of soil moisture tried were maintaining the soil moisture at 100 (M1), 75 (M2) and 50 percent (M3) field capacity, irrigating to field capacity whenever the surface layer dried up (M4) corresponding to farmers practice and at the appearance of first perceptible symptoms of wilting (M5) with three replications. Ten kg. of soil was taken in glazed porcelain pots. Twenty one days old seedlings were transplanted at the rate of 5 hills per pot with 2 seedlings in each hill. After giving life irrigation moisture regimes were established as per the programme and the same were maintained throughout the cropping period by weighing the pots daily and adding calculated quantity of water to replenish the

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moisture loss. Plant samples collected at tillering, flowering and post-harvest stages were analysed for their total N content by micro kjeldahl method (Humphries, 1956). From the N content of plant samples and straw and grain thus obtained the N uptake values were computed.

Experiment II. The second pot experiment was conducted with the soil collected from the University Campus. The moisture treatments consisted of irrigating to field capacity at 20 (M1), 40 (M2), 60 (M3), 80 (M4) and 100 percent (M5) available soil moisture depletion. Each treatment was replicated thrice. Soil moisture content between field capacity and 15 atmospheric pressure was taken as available soil moisture. Field capacity was estimated as per the method of Dastane (1967) and the moisture content at 15 atmospheric pressure was determined with a pressure membrane apparatus. Moisture levels were maintained by weighing the pots daily. Plant samples collected at various stages were analysed for their total N content and their uptake values computed as in experiment I.

Experiment III. A field experiment in a split plot design with moisture levels as main plot treatments and N levels as sub plot treatments was conducted during 1975 at the millet breeding station of the University farm. The treatments were the same as under experiment II. There were three replications with 20 plots of 5.0 X 1.5 m in each. Seedlings were planted giving a spacing of 15 cm on either side and after giving the life irrigation moisture regimes were maintained by gravimetric method. Required quantity of water to bring the soil moisture content to field capacity was applied by regulating the flow through a 'V' notch. Total N content of plant samples as well as the N uptake at various growth stages and plant parts were evaluated as in the previous experiments.

RESULTS AND DISCUSSION

N. Content: The details regarding the crop N content are presented in Tables 1 and 2.

Influence of soil moisture on the N content of plant parts, in general, were more in evidence at the advanced stages of the crop growth. The N content of straw and grain were more under lower moisture regimes than under higher available water supply. In all the three experiments the N content of grain was more susceptible to soil moisture variations than the N content of straw. Increased N content of plant parts under lower soil moisture regimes was attributed to reduced photosynthetic activities due to lesser vegetative growth, grains with low starch content and increased N accumulation in the form of protein (Tripathi 1971), increased proteolysis and translocation of the resulting compounds to the economic plant parts and reduced crop yield associated with drier moisture regimes (Cummings *et al.*, 1967). Enhanced crop yields and consequent dilution effect under higher soil moisture regimes as evidenced in the present studies could be the another reason for the increased N content under lower soil moisture regimes.

Increase in the levels of added N in general, increased the N content of plants in all the three experiments at all growth stages of the crop. This trend was not un-expected as N is the element which is required for the initial establishment as well as for vigorous growth of the crop and hence a variation in its content in the soil had resulted a variation in its content in the plants. Similar results of increased N content of plants with enhanced N application were reported by Partridge and Shaykewich (1972) and Dubetz and Bole (1973)

N. Uptake :

N uptake was higher under higher moisture regimes in all the three experiments. Similar finding of increased N uptake by the crop under higher moisture regimes was reported by Spratt and Gasser (1970). The increased N uptake under higher soil moisture regimes could be attributed to the increased dry matter yields. The influence of soil moisture levels on N uptake could be obesrved where ever the yield increases were associated with higher moisture regimes.

Increments of added N had a distinct effect on the N uptake by the crop. Highest level of N application resulted in the maximum N uptake by the crop. Similar results of enhanced N uptake due to increased N additions were reported by Reichman and Grunes (1966) and Sharma and Singh (1973). Incresed N application might have increased the vegetative growth, foraging capacity and the rate of photosynthesis (Tripathi 1971) resulting in increased dry matter accumulation. Higher dry matter accumulation was seen to reflect in higher N uptake. This conclusion was further substantiated by the positive relationships observed between available N content of soils at preplanting stage and dry matter yield and the total N uptake by the crop.

In experiment I, red soils in general had a higher N uptake than the black soils. This phenomenon was well exhibited especially at higher levels of added N. This was due to the fact that dry matter yields were higher in red soils than in black soils.

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TABLE 1　Content and uptake of N by ragi at different growth stages Experiment I (Mean values)

Treat-ment.	N content (%)							
	Tillering		Flowering		Straw		Grain	
	Black Soil	red Soil	Black Soil	red Soil	Black Soil	Red Soil	Black Soil	Red Soil
M1	1.74	2 39	0.56	0.65	0.39	0.45	0.83	0.85
M2	1.90	1.80	0.64	0 79	0 42	0.46	0 99	0.95
M3	2.31	1.91	0 89	0.79	0.58	0.45	1.41	0.95
M4	2.33	2.70	0.79	0.67	0.43	0.45	1.21	0·84
M5	1.81	2 30	0.83	3.77	0.49	0.44	1.16	0.84
N0	1.30	1.28	0.74	0.64	0 56	0.50	1.19	0.92
N1	2.06	1.42	0.67	0 65	0.43	0.43	1.11	0.81
N2	1.98	2.90	0.67	0.75	0.43	0.43	1 11	0.91
N3	2.74	3.30	0 83	0.89	3 36	0.43	1.15	0.91

	N uptake (mg/pot)								Total N uptake	
									Black Soil	Red Soil
M1	299	446	239	306	115	179	120	68	235	247
M2	319	371	260	364	139	189	143	132	282	321
M3	365	354	297	366	156	169	127	109	283	278
M4	267	304	231	239	89	142	106	119	195	261
M5	275	302	256	320	109	135	148	131	257	266
N0	121	130	103	122	55	78	60	42	115	120
N1	251	243	213	248	108	127	90	76	198	203
N2	331	439	295	374	149	197	143	143	292	340
N3	512	611	415	532	175	249	222	185	397	434

TABLE 2 Content and uptake of N by ragi Experiments II and III (Mean values)

Treatment	N content (per cent)						N uptake					
	Experiment II			Experiment III			Experiment II (mg/pot)			Experiment III (Kg/ha		
	Flowering	Straw	Grain	Flowering	Straw	Grain	Straw	Grain	Total	Straw	Grain	Total
M1	1.21	0.79	1.62	1.52	0.62	1.27	400	263	663	29	55	84
M2	1.44	0.77	1.43	1.51	0.66	1.44	348	241	589	27	51	78
M3	1.23	0 61	1.48	1.70	0 75	1.49	273	209	482	27	47	74
M4	1.11	0.78	1.57	1:64	0.75	1.48	362	246	608	27	42	69
M5	1.32	0.87	1.67	1.76	1.01	1.74	412	181	593	33	39	72
N0	1.08	0.64	1.29	1.36	0.63	1.36	222	125	347	19	34	53
N1	1.12	0.65	1.43	1.57	0.73	1.46	265	169	434	25	45	70
N2	1.35	0.79	1.73	1.69	0.79	1.53	397	268	665	33	51	84
N3	1.51	0.99	1.76	1.87	0.88	1'66	553	350	903	38	57	94