grain yield. Based on the present investigation, it could be concluded that pod number, pod length, cluster number, days to maturity, leaf area and TDMP should be taken into consideration while formulating selection programmes to improve grain yield in black gram.

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RELATIVE UTILISATION OF DIFFERENT ZINC CARRIERS IN WETLAND RICE *(Oryza sativa)*

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ABSTRACT

The utilisation of fertiliser zinc by rice crop was studied using few ^{65} Zn-labelled zinc carriers in a greenhouse experiment on an Udic Haplustalf and an Entic Chromustert. With respect to the yield of grain and straw, $ZnSO_4$ was found to be the best among the zinc carriers tried. Its effect was more pronounced when applied along with ammonium polyphosphate. However, the per cent zinc utilisation followed the order:-Zincated urea > $ZnsO_4$ > $ZnSO_4$ + APP > Zincated DAP.

KEY WORDS : Zinc sources, Wetland rice

Zinc deficiency is probably the most widespread micronutritional disorder the world over. Wetland rice is most susceptible since zinc is removed from the solution phase as insoluble zinc sulphide, silicate or zinc ammonium phosphate (Mikkelsen and Kuo, 1976). It is likely that high phosphorus levels and certain carbonate-bicarbonate relationships cause its

immobilisation. The deficiency can be set right by applying various zinc salts such as zinc sulphate. Sparingly soluble zinc oxide has worked well on acid soils. Various zinc chelates will satisfy the requirement but are not as effective as mineral salts (Patrick and Mikkelsen, 1971). Identifying the best source of zinc fertilisation would go a long way in mitigating this major nutritional disorder and improving the yields of rice. An investigation was, therefore, carried out to compare the zinc utilisation efficiency of different zinc carries grown on two major soil series of Tamil Nadu using ^{65}Zn as tracer.

MATERIALS AND METHODS

A greenhouse experiment was conducted on two major rice-grown soils of Tamil Nadu *viz.*, Madukkur series (Udic Haplustalf) and Nedumbalam series (Entric Chromustert). Some important initial characteristics of these soils are furnished in Table1.

Four zinc carriers, *viz.*, $ZnSO_4$ (23% Zn), $ZnSO_4$ (23% Zn) applied along with ammonium polyphosphate (APP), Zincated urea (2% Zn) and zincated diammmonium phosphate (6% Zn) were tried, each tagged with ^{65} Zn and carrying a specific activity of 37 MBq/g of Zn. Ceramic glazed pots, each with 10 kg of 2 mm-sieved soil, were used for the study. After bringing the soil in the pots to a puddled condition, the tagged fertilisers were applied so as to give an application level equivalent to 25 kg $ZnSO_4$/ha in all the treatments and thoroughly mixed with the soil. A common application of N,P and K was made to all the pots, including the control, @ 60 kg N/ha (urea), 60 kg P_2O_5/ha (Orthophosphoric acid) and 60 kg K_2O /ha (KCl) including the N and P contents carried by the four Zn treatments as the case may be. Then 21 day -old IR 50 rice seedlings were planted in the pots in three hills @ 2 plants/hill. Two top-dressings with urea were given, one on 21 days after planting (40 kg N/ha) and another on 42 days after planting (20 kg N/ha), such that the total dose of N applied did not exceed 120 kg N/ha in any case. The crop was grown to maturity. At harvest, the yields of grain and straw were recorded. The Zn content in the samples was estimated by atomic absorption spectrophotometry (Jackson, 1973) and the radioassay for ^{65}Zn activity was carried out in a NaIcrystal, well-type, gamma ray spectrometer (IAEA, 1976).

RESULTS AND DISCUSSION

All the zinc carriers recorded significantly higher yields of grain and straw as compared to control (Table 2) in both the soils. Among the carriers, $ZnSO_4$ was observed to be better than zincated urea or zincated DAP. The effect of $ZnSO_4$ was more pronounced when it was applied along with APP. Obviously, the proven characteristics of APP such as higher P_2O_5 (56%) content and its slow and steady availability throughout crop growth (Mistry and Yadav, 1981) have played complementary role.

In all the Zn treatments, Zn equivalent to 25 kg $ZnSO_4$/ha was applied basally. This entailed the application of the entire quantity of N basally in the case of zincated urea and there was no top-dressing with N to commensurate with different physiological growth stages of the crop. Hence this treatment had registered the lowest yield.

The total uptake of Zn by the crop also followed an identical trend as that grain and straw yields. The highest % Zndff was in zincated-urea, followed by $ZnSO_4$, zincated DAP and $ZnSO_4$ + APP. In the $ZnSO_4$ + APP treatment, the presence of APP had obviously a sequestering effect on the soil native pool as discussed earlier, thereby inducing more of soil Zn uptake and the phosphate radical in zincated DAP might have hindered the uptake of Zn from that source. Hence these two treatments had recorded a lower Zndff. The better performance of zincated urea was apparently due to the complementary effect of the accompanying N. A similar view has been expressed by Sarkar and

Table 1. Characteristics of initial soil samples

Property	Madukkur series (Udic Haplustalf)	Nedumbalam series (Entic Chromustert)
pH	7.10	7.60
EC (d Sm^{-1})	0.48	1.20
CEC (m.e./100 g)	20.40	31.80
Organic carbon (%)	0.42	0.56
Available nitrogen (kg/ha)	232	307
Available phosphorus (kg/ha)	12.12	9.28
Available potassium (kg/ha)	342	356
DTPA-Zn (ppm)	0.92	1.12
Texture	Clay loam	Clay loam

Table 2. Effect of treatments on dry matter yield, total Zn-uptake, % Zndff and % Utilisation of applied Zn in rice (IR.50) (Mean of 4 replications)

	Dry matter yield (g/pot)		Total uptake (mg/pot)	% Zndff	% utilisation of applied Zn
	Grain	Straw			
Zinc sources					
Control	21.0	24.0	1.78	-	-
$ZnSO_4$	33.0	34.8	4.98	4.25	0.83
$ZnSO_4$ + APP	36.2	37.7	6.00	0.24	0.16
Zincated urea	29.6	31.5	4.25	8.30	1.45
Zincated DAP	32.9	34.4	4.51	0.36	0.10
CD (at 5% level)	2.5	2.7	0.66	0.88	0.20
Soil					
Madukkur series	37.6	43.1	4.99	3.77	0.70
Nedumbalam series	23.8	25.4	3.62	2.80	0.40
CD (at 5% level)	1.6	1.7	0.42	0.62	0.14

Deb (1990). The per cent Zn utilisation which is computed from Zndff, followed a similar trend as that of the % Zndff. The treatments zincated urea and $ZnSO_4$ registered significantly higher per cent utilisation values than zincated DAP and $ZnSO_4$ + APP which were on a par.

The utilisation of applied Zn was significantly higher in the Madukkur series soil than in the Nedumbalam series soil as this soil had initially a lesser content of DTPA-extractable Zn. The results of this investigation showed that with respect to the yield of rice, $ZnSO_4$ was the best among the carriers tried. Applying $ZnSO_4$ along with APP further enhanced the yield response. There were indications that the sequestering effect of APP induced more of Zn uptake from soil pool.

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HETEROSIS AND INBREEDING IN BLACK GRAM (*Vigna mungo*)

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ABSTRACT

Heterosis (over mid-parental value), inbreeding depression and inbreeding vigour were estimated among twenty hybrids generated from a 5x5 diallel analysis involving Co 4, Co 5, UG 135, UG 191 and T 9 as parents for total dry matter production (TDMP), grain yield, and harvest index. Wide range of heterosis, inbreeding depression and inbreeding vigour was observed among hybrids for all the characters studied. The implications of heterosis, inbreeding depression and breeding vigour on formulating the improvement programme was discussed and the best cross combinations which would throw superior segregants in the subsequent generations were identified.

KEY WORDS : Black gram, Heterosis, Inbreeding

Heterosis is the superiority of the hybrid over mid parent and better parent. This superiority may be in yield,quality, disease and insect resistance or susceptibility. In many cross pollinated crops, heterosis has been commercially exploited, for example in maize, baira, jowar, cotton, sunflower,