Table 5. Reaction to diseases - (Field Score) Mean score

Year & Location(s)	Late leaf spot (1-9 scale)	Rust (1-9 scale)	Bud necrosis (%)*
1995 kharif MLT (4 locations)			
TNAU 256	4.8	4.8	0.0
VRI 2	5.8	5.4	3.1
Co 2	6.1	5.5	3.8
1995 summer MLT (2 locations)			
TNAU 256	5.1	5.7	0.4
VRI 2	6.3	6.0	0.9
Co 2	6.2	4.2	0.8
1998 kharif (Coimbatore)			
TNAU 256	4.3	-	3.8
VRI 2	5.2	-	10.7
Co 2	6.4	-	11.3

* In All India Trials ; this culture (TNAU 256) has been identified as resistant genotype for BND (bud necrosis)

Table 6. Groundnut - Pod and Kernel Characteristics (HPS)

No. Entry	100 Pod wt. (g)	100 Kernel wt. (g)	Shelling outturn (%)	Oil content (%)
BUNCH :				
1. TNAU 256	163.0	60.9	71.4	49.2
2. CO 2	125.4	45.5	71.5	47.3
3. VRI 2	135.8	50.4	71.2	48.0

suitable for HPS category along with low incidence of bud necrosis has been released as CO 3 during January 1999 for general cultivation for growing in groundnut tracts of Tamil Nadu.

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INTEGRATED NITROGEN MANAGEMENT OF LOWLAND TRANSPLANTED RICE OF WEST ZONE OF TAMIL NADU

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ABSTRACT

Field experiments were conducted during 1991-94 at Tamil Nadu Agricultural University, Coimbatore to develop integrated N management practice for lowland transplanted rice. The treatments included placement of urea super granules (USG) at 100 kg N/ha, application of prilled urea (PU) at 100 kg N/ha, application of 75 kg N as PU with azolla or FYM or green manure or azospirillum and application of 50 kg N as PU with the combined use of azospirillum, azolla and green manure. The results of three-years study revealed the superiority of the placement of USG over the other treatments. The next best treatment was the application of PU at 100 kg N/ha. However, application of 75 Kg N as PU combined with either azolla or green manure (*Sesbania rostrata*) registered comparable yields. Substitution of 25 kg N as chemical fertiliser with either azolla or green manure was clearly seen. Possibility of substitution of chemical N fertilisers even to the extent of 50 per cent by the combined use of 50 kg N as PU with Azospirillum, azolla and *Sesbania rostrata* green manuring was also observed.

KEY WORDS : Integrated nitrogen management, Lowland rice

Escalation of the cost of chemical fertilisers, deterioration of soil health and productivity by the continuous use of large quantities of chemical fertilisers and concern for sustainable agriculture with emphasis on ecologically friendly inputs have resulted in the renewed interest on organic manures and biofertilisers. Many research workers have reported that organic manures/biofertilisers could substitute a subatantial part of the chemical fertilisers, especially N fertilisers, without any

Table 1. Yield components and grain yield during kharif season

Treatments	Panicles/m²			Panicle weight (g)			Grain yield (Kg/ha)		
	1991	1992	1993	1991	1992	1993	1991	1992	1993
T_1 : control (No N)	309	272	423	1.39	1.81	1.79	3740	4196	3984
T_2 : 100 kg N/ha as Urea Super Granules (USG)	455	388	549	1.67	2.75	2.68	6641	6599	6309
T_3 : 100 kg N/ha as Prilled Urea (PU)	405	360	527	1.57	2.69	2.60	5497	6505	5951
T_4 : 75 kg as PU + 25 kg N as Azolla/ha	413	312	522	1.65	2.32	2.27	5851	6429	5808
T_5 : 75 kg N as PU + 25 kg N as *Sesbania rostrata* green manuring/ha	441	319	518	1.44	2.52	2.49	5783	6350	5412
T_6 : 75 kg N as PU + 25 kg N as FYM/ha	424	310	491	1.60	2.21	2.20	5746	5567	5097
T_7 : 75 kg N as PU + Azospirillum	384	315	484	1.43	2.29	2.25	5074	5598	4598
T_8 : 50 kg N as PU + Azospirillum + 25 kg N as Azolla + 25 kg as *Sesbania rostrata* green manuring	435	327	505	1.65	2.55	2.51	5974	6309	5018
C.D (P=0.05)	33.8	24.0	33.9	NS	0.18	0.10	597	750	154

reduction in rice crop yields. (Shanmugam, 1983 ; Senapati, 1986 ; Hussain and Jilani, 1989; Khind *et al.*, 1992). Field experiments was conducted to assess the extent to which chemical N fertilisers could be substituted by the use of organics in lowland rice under irrigated conditions.

MATERIALS AND METHODS

Field experiments were conducted at the Central Farm, Tamil Nadu Agricultural University, Coimbatore during 1991-94. The soil was clay loam with pH 7.9, organic carbon 0.64 per cent, low in available N (189 Kg/ha), medium in available P_2O_5 (14 kg/ha) and high in available K (487 kg/ha).

The experiment was laid out in randomised blocks design with four replications. The treatments were : T_1 : Control (No N) ; T_2 : 100 kg N as urea super granules (USG); T_3 : 100 kg N as prilled urea (PU) applied in splits ; T_4 : 75 kg N as PU + Azolla (inoculated at 100g/m² 5 DAP and the multiplied azolla incorporated into the soil ar 25 DAP); T_5: 75 kg N as PU + *Sesbania rostrata* incorporation one week before planting so as to supply 25 kg N; T_6 : 75 kg N as PU + FYM to supply 25 kg N; T_7 : 75 kg N + Azospirillum (seed treatment – 400 g, seedling root dipping – 600g, main field application – 3000g); T_8 : 50kg N as PU – Azospirillum (as in T_7) + Azolla (as in T_4) *Sesbania rostrata* incorporation to supply 25 kg N. Urea super granules were placed at 10 cm depth a week after planting. Prilled urea was applied in four equal splits – at planting, at tillering, at panicle initiation and at heading. The full dose of P_2O_5 (50 kg/ha) was applied as basal dose. The K_2O (50 kg/ha) was applied in four splits along with urea. The control plot received only P and K. Short duration variety IR 50 and medium duration variety CO 45 were used for the *kharif* and *rabi* seasons respectively. The treatments were imposed in the same plots for the three years.

RESULTS AND DISCUSSION

Kharif rice (Table 1)

In all the three years, placement of urea super granules (USG) at 100 kg N/ha recorded the highest number of panicles/m² and panicle weight and consequently the highest grain yield. However, application of 100 kg N/ha as prilled urea (PU) registered comparable number of panicles per unit

Table 2. Yield components and grain yield during rabi season

Treatments	Panicles/m²			Panicle weight (g)			Grain yield (Kg/ha)		
	1991-1992	1992-1993	1993-1994	1991-1992	1992-1993	1993-1994	1991-1992	1992-1993	1993-1994
T_1 : Control (No N)	255	306	418	2.06	2.48	2.34	4184	3938	4224
T_2 : 100 kg N/ha as Urea Super Granules (USG)	325	357	477	2.67	2.92	2.86	5731	5779	5438
T_3 : 100 kg N/ha as Prilled Urea (PU)	327	348	497	2.75	3.14	2.99	5223	5461	5392
T_4 : 75 kg as PU + 25 kg N as Azolla/ha	302	348	485	2.35	2.83	2.80	5613	5092	5315
T_5 : 75 kg N as PU + 25 kg N as *Sesbania rostrata* green manuring/ha	288	354	467	2.29	2.85	2.74	5175	5102	5275
T_6 : 75 kg N as PU + 25 kg N as FYM/ha	282	320	441	2.22	2.81	2.65	5076	4927	5200
T_7 : 75 kg N as PU + Azospirillum	291	343	444	2.21	2.76	2.81	5225	4966	5080
T_8 : 50 kg N as PU + Azospirillum + 25 kg N as Azolla + 25 kg as *Sesbania rostrata* green manuring	307	354	492	2.22	2.81	2.85	5394	5456	5242
C.D (P=0.05)	12.8	21.5	21.1	0.11	0.05	0.24	512	343	529

area in1993, panicle weight during 1992. Application of 75 kg N/ha as PU along with azolla dual crop incorporation also registered similar grain yield in 1992. Comparable grain yield was achieved, when 50 Kg N/ha as PU was combined with the use of azospirillum, *Sesbania rostrata* green manuring and azolla dual crop incorporation.

Rabi rice (Table 2)

Eventhough the highest number of panicles per unit area and panicle weight were recorded in plots which received 100 kg N/ha as PU, the highest grain yields could be registered in USG applied plots. However, grain yield during *rabi* season was of comparable magnitudes in USG and PU applied plots and in 75 kg N/ha as PU combined either with azolla or *Sesbania rostrata* green manured plots and in 50 kg N/ha as PU combined with azospirillum, azolla and *Sesbania rostrata* applied plots.

Pooled data (Table 3)

While the highest panicle number/m² in *Kharif* rice could be recorded in USG treatment, the *rabi* rice registered the highest panicle weight in PU treatment. However, the panicle number as well as the panicle weight were compable in these two treatments. Consequently, the grain yield was also of comparable quantities in these two best treatments.

The placement of USG might have resulted in higher efficiency compared to urea prills application. This higher efficacy is attributed to slower urea hydrolysis because of lesser contact of urea with soil particles, retention of N in soil for a longer period due to slower rate of formation of ammonium nitrogen and lower nitrite concentration with the USG. (Soni and Rajendra Kaur, 1989); Kavimani and Rajasekaran 1991). However the practical difficulty in the adoption of USG placement is the engagement of manual labour. It may not be a feasible proposition, when the labour availability is a constraint in command areas during peak period of planting. The other major problem is the non-availability of USG on a commercial scale. Unless suitable machinery for placing the USG in the reduced soil layer is developed and the USG is made available commercially, the beneficial effect of USG cannot be realised.

Table 3. Pooled yield components and grain yield during *kharif* and *rabi* seasons and economics of N management in lowland rice

Treatments	Pooled-kharif 1991-1993			Pooled-rabi 1991-92 to 1993-94			Net returns (Rs/ha)	B:C ratio
	Panicle/ m^2	Panicle weight (g)	Grain yield (kg/ha)	Panicle m2	Panicle weight (g)	Grain yield (kg/ha)		
T_1 : Control (No N)	335	1.66	3973	326	2.30	3949	11168	1.23
T_2 : 100 kg N/ha as Urea Super Granules (USG)	464	2.36	6516	386	2.81	5696	21005	2.11
T_3 : 100 kg N/ha as Prilled Urea (PU)	431	2.28	5984	391	2.96	5359	19081	1.96
T_4 : 75 kg as PU + 25 kg N as Azolla/ha	416	2.08	5896	378	2.66	5340	18595	1.80
T_5 : 75 kg N as PU + 25 kg N as *Sesbania rostrata* green manuring/ha	426	2.15	5848	370	2.63	5184	17987	1.80
T_6 : 75 kg N as PU + 25 kg N as FYM/ha	408	2.00	5470	348	2.56	5068	16394	1.59
T_7 : 75 kg N as PU + Azospirillum	394	1.99	5090	359	2.59	5090	16180	1.68
T_8 : 50 kg N as PU + Azospirillum + 25 kg N as Azolla + 25 kg as *Sesbania rostrata* green manuring	422	2.24	5767	386	2.63	5364	17970	1.76
	C.D	C.D	C.D	C.D	C.D	C.D	C.D	
Treatment	17.2	0.10	311	10.5	0.08	204	1950	
Year	10.5	0.06	NS	6.4	0.05	NS	725	
Treatment x Year	29.7	0.17	539	18.2	0.15	NS	2835	

The study revealed the effectiveness of 100 kg N/ha as prilled urea applied in split doses. Continued availability of plant nutrient over an extended period of time in accordance with the plant requirement might be the result of split application of prilled urea which made its application comparable with the placement of USG. The USG and PU application were comparable in terms of economic analysis.

The organic sources of N viz., azolla dual crop with rice and *Sesbonia rostrata* green manuring resulted in the substitution of 25 per cent of the chemical N fertilisers without any reduction in rice crop yields during *Kharif* as well as *rabi* seasons. The combined use of azospirillum, *S.rostrata* and azolla along with 50 per cent of chemical N fertiliser resulted in comparable yield level with that of application of PU at 100 kg N/ha. The N economy by the use of organics, either green manure or azolla or biofertilser could be achieved in lowland transplanted rice in clay loam soils of west zone of Tamil Nadu. The possibility of substituting chemical N fertilisers even to the extent of 50 per cent in lowland transplanted riece was very much evident from the results of the present investigation.

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PHYSICAL CHANGES INDUCED BY MINERAL, ORGANIC AND INDUSTRIAL AMENDMENTS ON A VERTISOL AND ITS EFFECT ON YIELD OF FINGER MILLET (*ELEUSINE CORACANA GEARTN.*)

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ABSTRACT

Application of soil amendments apart from improving the soil physical properties also gave higher yields of finger millet. The efficacy of amendments may be graded as follows: organic amendments > industrial wastes > mineral wastes. Within the above group the order of efficacy in each group was as follows: 1) Organics : Poultry manure > farm yard manure > maize straw > cotton waste. 2) Industrial Wastes: Lime sludge > furnace slag > cement dust. 3) Mineral amendments : Gypsum > magnesite> tank silt. Incorporation of amendments resulted in significant reduction in bulk density and soil strength, and increase in hydraulic conductivity, stability index, aggregate stability and available water content.

KEY WORDS: Mineral industrial and organic wastes –Soil physical properties- Ragi (*Eleusine Coracana*)

Application of soil amendments restores the physical conditions of degraded tropical soils. Different types of crop and animal residues, organic and inorganic wastes were used as amendments to improve soil physical properties (Nuttal,1970; Moagwa, 1992). Adequate information on the utilization of industrial wastes as amendments and their relative efficiency as against organic and mineral amendments is not available. Hence the present study was undertaken to evaluate the influence of applying agricultural, industrial and mineral wastes as amendments to improve the physical properties of black soil and the yield of finger millet.

MATERIALS AND METHODS

A field experiment with finger millet as the test crop was laid out in a Vertisol (Typic chromustert) of silty clay loam texture.

Following were the treatments: Main plot treatments : T_1 – Farm Yard manure (FYM); T_2- Maize straw (MS); T_3- Poultry manure (PM); T_4- Cotton waste compost (CEC); T_5- Tank silt (TS); T_6 – Gypsum; T_7-Magnesite; T_8- Furnace slag (FS); T_9-Cement dust (CD); T_{10}-Lime slag and T_{11}- Control. Treatments 1 to 5 were applied at 25 t ha^{-1} and T6-T10 were added at 10 t ha^{-1}. The amendments were well incorporated into the soil 30 days before transplanting. Sub-plot treatments; F_0 – Amendments alone; and F_1 – Amendments with recommended dosage of fertiliser (N : P_2O_5 : K_2O at 95 : 45 : 45: 22.5 kg ha^{-1}). The treatments were replicated thrice in a split-plot design.

Pre-planting and post-harvest soil samples cores of 75 mm dia and 75 mm height were collected at 0-20 cm depth. Dry bulk density was estimated by using the method of Black (1965). Volumetric