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Studies on Inorganic Salts Sprays as Rice Desiccants

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Field desiccation of rice hastens ripening and facilitates early harvest. Effects of preharvest sprays of different concentrations of potassium chloride, calcium chloride, diammonium phosphate, pyrite, sodium carbonate, calcined lime sprays in comparison with common salt spray as field desiccant on different varieties of paddy in both *kuruvai* and *thaladi* seasons during four years were studied Either potassium chloride, diammonium phosphate, pyrites or calcium chloride sprays can be used as an alternative rice desiccant to common salt spray. Besides appreciable reduction in grain moisture and change in glume colour from green to yellow, these sprays significantly influenced the field recovery of paddy and facilitated harvesting earlier by 6 days.

Field desiccation of rice has many advantages-brings about uniform yellowing of grains, (Pillaiyar *et al.*, 1973; Ramiah *et al.*, 1974; Ramanujam *et al*,, 1979 , hastens ripening phase (Bhole and Thakur, 1976; Ramiah *et al* , 1979), reduction in grain and straw moisture in field (Ramanujam *et al.*, 1979; Sethuraman *et al*.. 1981), ease of thrashability (Nagarajan *et al.*, 1981), more grain recovery (Nagarajan *et al*,, 1981) with no ill-effect on storability, germinability (Paddy Processing Research Centre, 1980) and milling recovery (Pande and Pande, 1976). Though the desiccation effects of common salt (NaCl) (Pillaiyar *et al.*, 1973; Ramiah *et al.*, 1974 & 1979; Bhole and Thakur, 1976) solution and different herbicides (Ramanujam *et al.*, 1979; Vaidhyalingam *et al.*, 1980) have been fully studied, considering the necessity (possible cumulative effect of NaCl spray on soil pH and E. C.) for finding an alternative to common salt spray, a study on the efficacy of various inorganic salt sprays was taken up and the results are presented.

MATERIAL AND METHODS

Field trials in both the *kuruvai* and *thaladi* seasons were conducted in the fields of the Paddy Experiment Station, Aduthurai adopting randomised block/split plot designs with Adt 31, Adt 34, IR 20 and IR 34 varieties of paddy. The recommended cultural practices including the fertilizer application and plant protection measures were followed. Different concentrations of commercial salt solutions-Potassium chloride (KCl) 5 and 10%; Calcium chloride ($CaCl_2$) 5 and 10%; Diammonium phosphate ($(NH_4)_2HPO_4$) 5 and 10%; Pyrites (FeS_2) 5 and 10%; Sodium carbonate (Na_2Co_3) 10, 5, 2 and 1%; Calcined lime (CaO) 10%; Common salt (NaCl) 20% were sprayed at 500 l/ha on 27-day (1978), 26-day (1979) of general flowering (G. F.) in *kuruvai* and 25-day (1976-77) 27-day (1977-78) and 22-day (1978-79; 1979-80) of G. F. in *thaladi* seasons (the stage of full maturity of IR 20

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varied from year to year depending on the period of raising the nursery-this again depended on the date of receipt of canal water here) with an Aspee knapsack sprayer and the crop was harvested after 48 hr of spraying along with unsprayed parallel control crop (Control I). Other set of control plots that remained in field for 6 days more (this is the stage at which farmers usually harvest rice) was also harvested (Control II). Immediately after harvest, the sheaves were thrashed, winnowed and the yield recorded to 14% moisture content (air oven). To determine the extent of thrashability, the grains that remained on the labelled panicles after thrashing were counted and expressed as percentage to total grains in the panicle.

Ten randomly selected panicles were labelled, the total and green grains counted before and after 48 hr of spraying. Random panicles (prime earhead in hills) were clipped off before and after 48 hr of spraying for determining the grain moisture by desiccating in hot air oven at 105±1°C for 24 hr.

RESULTS AND DISCUSSION

i) *Change in glume colour*:

The green grains at the time of spray ranged from 11.8 to 23.0% in *kuruvai* and 10.2 to 16.3% in *thaladi* seasons. Spraying different salt solutions resulted in a significant change in the glume colour from green to yellow (Table 1). Of the different salt solutions, the effects of sodium carbonate, potassium chloride calcium chloride, pyrites and diammonium phosphate sprays on the change of glume colour were more or less the same and equal to common salt (20%) spray; the extent of reduction in green grains occurred in 48 hr of spraying was equal to that occured in 6 days of natural desiccation i. e. in the Control II Except in case of sodium carbonate sprays were 10% and 5% caused deep yellowing of glumes and bran layers, other salt sprays changed the green coloured glumes into normal straw coloured and the kernel colour did not change. While 10% salt sprays exhibited pronounced effect on glume colour, the effect of 5% sprays also was more or less the same. The change in the straw colour was only partial as the action of these chemicals is by contact; whereas spraying herbicidal desiccants changed the colour of the entire plant fully (Ramanujam *et al.*, 1979).

ii) *Moisture drop*:

The grain moisture at the time of full maturity of the crop was ranging from 20.8 to 26.7% in *kuruvai* and 19.6 to 23.6% in *thaladi*. (The grain moisture at this stage varied from year to year depending on the month during which the crop attained maturity and the weather conditions prevailed then). Spraying inorganic salt solutions at this stage resulted in significant moisture reduction (Table 2) with appreciable effect in the cases of potassium chloride, calcium chloride, diammonium phosphate and pyrites. Similar extent of moisture reduction was noticed in cases of spraying the crop with common salt solution and herbicides (Pillaiyar *et al.*, 1973; Ramaiah *et al.*, 1974; Bhole and Thakur, 1976 and Ramanujam *et al.*, 1979).

iii) *Field Yield*:

Spraying these salt solutions at full maturity stage of paddy significantly influenced the field yield (Table 3). The increase in yield is attributable to high recovery of grains during thrashing and the minimal quantity of unthrashed grains left with straw after thrashing operations and due to early harvest by 6 days than the usual harvesting stage practised by the farmers. In all our earlier studies, (Sethuraman *et al.*, 1981; Nagarajan. *et al.*, 1981), higher field recovery was noticed in cases of harvests followed by pre-harvest desiccant sprays.

None of the inorganic salts spray affected the germinability of grains and the milling qualities (Paddy Processing Research Centre, 1980). Among the different salts, potassium chloride and diammonium phosphate are used as fertilizers, and calcium chloride and pyrites as soil ameliorants. Either of these salts depending on the soil conditions can be used as pre-harvest rice desiccant in place of common salt solution for early ripening and higher field recovery. However in view of easy availability and cost considerations, common salt spray may be preferred in places where the accumulation of sodium chloride in soil maynot pose problems (Pillaiyar *et al*, 1973; Ramiah *et al.* 1974; Bhole and Thaku, 1976).

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TABLE 1 Effect of inorganic salts spray on the change in colour of glumes
(Reduction in grains (%) with green glumes after 48 hr.)

Treatments	Kuruvai			Thaladi				
	1978	1979	1979	1976-77	1977-78	1978-79	1979-80	
	Adt 31	Adt 31	Adi 34	IR 20	IR 20	IR 20	IR 20	IR 34
Sodium chloride 20%	10.77	10.26	11.82	10.10	7.62	12.43	14.15	13.39
Potassium chloride 10%	13.12	7.54	8.31	7.00	10.56	11.99	14.08	14.28
Potassium chloride 5%	8.99	*	*	*	7.26	11.61	8.38	14.29
Diammonium phosphate 10%	12.24	7.51	7.47	9.60	8.11	12.56	13.18	13.37
Diammonium phosphate 5%	10.08	5.64	6.53	*	7.35	12.71	14.61	13.72
Calcium chloride 10%	10.63	12.67	12.18	6.40	7.73	11.61	*	*
Calcium chloride 5%	10.80	*	*	*	8.29	11.33	*	*
Lime 10%	*	7.96	7.40	*	*	*	*	*
Sodium carbonate 10%	*	*	*	7.00	*	*	*	*
Sodium carbonate 5%	11.24	10.24	10.83	*	9.23	12.61	*	*
Sodium carbonate 2%	10.83	*	*	*	8.94	10.40	13.09	14.17
Sodium carbonate 1%	9.56	*	*	*	7.16	11.93	12.93	14.54
Pyrites 10%	10.09	*	*	*	10.56	10.99	13.91	13.37
Pyrites 5%	10.18	*	*	*	9.34	12.59	13.09	12.58
Control I	8.05	3.78	4.74	0.40	5.38	4.85	6.81	7.24
Control II	9.20	9.87	9.20	11.30	8.86	*	12.21	11.02
S. E.	0.409	0.898	0.836	1.380	0.379	0.576	0.753	0.651
C.D.(P=0.05)	0.884	2.069	1.929	3.327	0.818	1.256	1.677	1.451

* not included in the particular year

TABLE 2 Effect of inorganic salts spray on the grain moisture reduction in paddy
(Per cent)

C.D.(P=0.05)	0.884	2.069	1.929	3.327	0.818	1.256	1.677	1.451

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	1978	1979	1979	1976-77	1977-78	1978-79	1979-80	
	Adt 31	Adt 31	Adt 34	IR 20	IR 20	IR 20	IR 20	IR 34
Sodium chloride 20%	2.50	3.37	3.40	2.4	4.08	4.10	3 40	4.5
Potassium chloride 10%	1.90	4.27	4.70	1.9	2.22	3·55	2.00	4.3
Potassium chloride 5%	1.65	*	*	*	1.28	3.35	1.60	3.5
DAP 10%	1.45	4.77	5.10	2.5	5.15	3.60	3.10	4.3
DAP 5%	1.90	3.37	4.20	*	3 88	3.10	2.40	3 2
Calcium chloride 10%	2.60	4.57	4.80	2.4	2.98	4.15	*	*
Calcium chloride 5%	1.65	*	*	*	2.25	3.80	*	*
Lime 10%	*	2.57	3.00	*	*	*	*	*
Sodium carbonate 10%	*	*	*	1.6	*	*	*	*
Sodium carbonate 5%	1.50	*	*	*	2.48	4.15	*	*
Sodium carbonate 2%	1.10	2.67	2.60	*	1.85	3.30	3.40	3.8
Sodium carbonate 1%	0.70	*	*	*	0.95	2.90	2.90	3.2
Pyrites 10%	1.80	*	*	*	3.35	3.80	3.20	4.4
Pyrites 5%	0.60	*	*	*	3.05	2.75	2.00	3.5
Control I	0.85	2.17	2.10	1.0	1.35	1.60	1.50	2.2
Control II	3.20	1.77	1.50	3.6	4.95	*	3.70	4.7
S. E.	0.193	0.359	0.428	0.253	0.402	0.198	0.236	0.177
C. D. (P=0.05)	0.416	0.827	0.988	0.620	0.868	0.432	0 256	0 395

not included in the particular year

TABLE 3. Effect of different inorganic salts spray on the grain yield of paddy (kg / ha)

Treatments	Kuruvai. 1978	Thaladi 1978-79	Kuruvai 1979		Thaladi 1979-'80	
(Solutions of)	Adt 31	IR 20	Adt 31	Adt 34	IR 20	IR 34
Common salt (20%)	4872	3806	5002	4368	1735	1950
Potassium chloride (5%)	4797	3626	-	-	1679	1855
Potassium chloride (10%)	4336	3573	5331	5143	1656	1833
Calcium chloride (5%)	4108	3318	5218*	5169*	-	-
Calcium chloride (10%)	4208	3646	5028	4781	-	-
Daimmonium phosphate (5%)	4247	3253	4810	4774	1698	1929
Daimmonium phosphate (10%)	4058	3545	5263	4991	1821	1854
Pyrites (5%)	4089	3552	-	-	1683	1898
Pyrites (10%)	4217	3287	-	-	1841	1927
Sodium carbonate (1%)	4100	3793	-	-	1668	1854
Sodium carbonate (2%)	4392	3210	-	-	1766	1864
Sodium carbonate (5%)	4039	3072	5316	5085	-	-
Control I	4753	3418	4987	4859	1683	1789
Contral II	4267	-	4950	5013	1754	1979
S. E.	483.34	74.38	125.02		29.9	
C. D. (P=0.05)	1477.79	N. S	1207.34		84.24	

* Calcined lime 10%