the effect of recommended rates of commonly used rice herbicides (see table) on azolla. The study was in a randomized complete block design with four replications.

Azolla caroliniana Willd. was inoculated at 500 g fresh weight/m^2 immediately after transplanting. Except for oxadiazon applied 3 d before transplanting, all herbicides were applied 4 d after transplanting.

Except for thiobencarb, piperophos - 2, 4-D, and oxadiazon, all herbicides significantly reduced azolla fresh weight by 10 d after treatment. The proprietary mixture of molinate - simetryn - MCPB was most damaging to azolla. Herbicides did not affect azolla N content.

By 20 d after treatment, all herbicides reduced azolla growth. Molinate - simetryn - MCPB killed all azolla. Thiobencarb was least harmful, reducing azolla fresh weight 29% compared to the untreated check.

The herbicides had no significant effect on azolla N content. However, had azolla been incorporated 20 d after herbicide application, there would have been significant differences in the amount of N incorporated because of the different fresh weights.

Weed control measures other than herbicides should be used when azolla is grown.

Fresh weight and N content of azolla as affected by herbicide application.[a] IRRI, 1984 wet season.

Treatment	Herbicide rate (kg/ha)	Fresh weight (g/m^2) 10 d	Fresh weight (g/m^2) 20 d	N content (%) 10 d	N content (%) 20 d
Molinate - simetryn - MCPB	0.93	185 f	0 g	2.5 a	–
Butachlor - 2,4 -D	1.25	223 ef	32 fg	2.8 a	1.5 a
Butachlor	1.0	310 cdef	77 ef	2.9 a	1.5 a
2,4-D	0.8	216 def	148 ef	2.9 a	2.7 a
Oxyfluorfen	0.14	310 cdef	238 def	2.8 a	2.5 a
Naproanilide - thiobencarb	1.7	348 bcdef	198 defg	2.7 a	2.5 a
Pendimethalin	0.75	383 bcdef	160 efg	2.6 a	2.3 a
Thiobencarb - 2,4-D	1.2	365 bcdef	289 cde	2.6 a	2.4 a
Piperophos - 2,4-D	1.0	485 abcd	191 defg	2.7 a	1.3 a
Oxadiazon	0.75	438 abcde	489 bc	2.5 a	2.6 a
Thiobencarb	1.0	612 a	521 b	2.8 a	2.4 a
Untreated	–	603 a	135 a	2.8 a	2.5 a

[a] Observations were made 10 and 20 d after herbicide application. Means followed by a common letter are not significantly different at the 5% level.

Effect of soil amendments on summer growth and survival of *Azolla pinnata*

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It is difficult to maintain azolla under field conditions in summer in tropical rice growing areas. We studied the effect of soil amendments on summer azolla growth in Apr 1984.

The experiment was in a randomized block design with 4 replications in 1-m^2 plots. The following amendments were added to the plots and mixed thoroughly: 50 kg P/ha, 50 kg K, 500 kg neem cake, 50 kg diammonium phosphate, 10 t rice husk, 5 t fresh cow dung, 10 t rice husk, 10 t rice chaff, 5 t farmyard manure, and 10 t sawdust, *Azolla pinnata* was inoculated at 400 g/m^2 in 10-cm-deep water. Fronds floated on the water for 2 d and then settled on the soil. Soil was kept saturated for 3 wk.

The number of fronds, biomass/10 cm^2, single frond weight, and root length were recorded. Biomass increased over the control in all treatments except that of K and sawdust. The most fronds survived on rice chaff, which gave the highest single frond weight, followed by cow dung and diammonium phosphate. Rice husk gave the longest root length (see table).

Results showed that soil amendments influence azolla growth and survival in summer. Rice chaff increases moisture holding capacity. Allowing azolla to root may enhance survival over maintaining the fronds in floodwater.

Effect of soil amendments on azolla growth and survival of azolla in summer, Tamil Nadu, India.

Treatment	Azolla fronds (no./10 cm^2)	Root length (cm)	Single-frond wt (mg)	Biomass (g/10 cm^2)
Control	96	1.4	47.7	14.3
Superphosphate	114	1.2	49.3	15.3
Muriate of potash	107	1.7	49.7	13.0
Neem cake	193	1.8	52.0	20.3
Diammonium phosphate	222	1.9	62.3	23.7
Farmyard manure	88	1.5	45.7	15.3
Cow dung	223	1.3	61.3	22.0
Rice husk	115	2.4	64.3	21.7
Rice chaff	311	1.8	76.3	35.0
Sawdust	99	2.1	44.0	12.7
SE :	4	0.1	2.0	0.6
SEd :	5	0.2	2.8	0.8

Some physiological studies on rice grown on manganese-deficient soil

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Wheat grown in rotation with rice on coarse Punjab soils is showing increasing Mn deficiency, but rice has shown no visual symptoms. To understand this tolerance mechanism, we grew PR103 in a Mn-deficient (DTPA Mn 0.8 mg/kg) loamy sand soil