were between leaf number and leaf length, leaf length and grain yield and between leaf breadth and stem girth. In the hybrids also, all the correlations were positive. However, only leaf breadth and stem girth were found to be significantly correlated with grain yield; the other two, *i.e.*, number of leaves and leaf length, were not significant.

However, to ascertain the direct and indirect effects of the four leaf and stem characteristics on grain yield in the inbreds and hybrids of pearl millet, path-coefficient analysis was undertaken (Table II). It is apparent that

TABLE II

Direct and indirect effects of some physiological traits on grain yield in the inbreds and hybrids of pearl millet

	Inbreds	Hybrids
1. Number of leaves *vs.* grain yield:		
Direct effect	0·0225	−1·3295
Indirect effect *via* leaf length	−0·2486	−0·0453
,, leaf breadth	0·4209	0·8939
,, stem girth	0·4609	0·7035
2. Leaf length *vs.* grain yield:		
Direct effect	−0·4087	−0·0699
Indirect effect *via* no. of leaves	0·0136	−0·8628
,, leaf breadth	0·4272	0·8668
,, stem girth	0·4164	0·1013
3. Leaf breadth *vs.* grain yield:		
Direct effect	0·5739	1·3185
Indirect effect *via* No. of leaves	0·0165	−0·9014
,, leaf length	−0·3042	−0·0459
,, stem girth	0·3803	0·0740
4. Stem girth *vs.* grain yield:		
Direct effect	0·6123	1·1852
Indirect effect *via* No. of leaves	0·0169	−0·7892
,, leaf length	−0·2779	−0·0060
,, leaf breadth	0·3565	0·0824

number of leaves and the length of leaf had negative direct effects in the hybrids. In the inbreds also, leaf length exerted a negative influence while the direct effect of the number of leaves was negligible. On the other hand, leaf breadth and stem girth appeared to influence grain yield substantially through their direct effects. Their indirect effects were also of considerable magnitude through number of leaves and leaf breadth. These characters thus appear to contribute directly as well as indirectly to grain yield in both homozygous and heterozygous populations.

The studies indicate that varieties with thick stems and small but broader flag leaf may be more productive than those with thin stems and narrow flag leaf. Numerous long and drooping leaves will produce a self-shading effect and diminish the photo-receptive areas of leaves resulting thereby in reduced photosynthetic activity. Therefore, plants with fewer, short erect leaves and thick stems may be expected to produce more yield. Although grain yield in pearl millet is generally dependent on increased single head weight and high tillering,[4] emphasis should also be laid on the leaf and stem characteristics for an efficient selection of high-yielding genotypes.

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FOLIAR SPRAY OF UREA FOR YIELD INCREASE IN RICE

EFFICIENCY of applied nitrogen for rice production was suggested by Matsushima[2] to be improved by adequate supply at the neck-node differentiation stage. This is achieved by increase in the number of spikelets per panicle and less degradation of spikelets. A positive correlation between leaf nitrogen at this stage and the grain yield was found. Panicle primordia initiation stage has also been recommended by Hall and Railey[1] to be a critical stage for part nitrogen fertilization.

Field experiments were conducted at the Indian Agricultural Research Institute, New Delhi, during the *Kharif* (July-October) season of the years 1968 and 1969 on a sandy clay loam soil. The treatments comprised three dwarf varieties and a tall *indica* rice variety as the main-plot treatments and five levels of nitrogen and two methods of fertilizer application as sub-plot treatments. Application of nitrogen was split up by supplying 80% of it at transplanting (basal) and the rest at panicle initiation stage either through soil application (top-dressing) or as foliar spray of 3% urea solution in one to four applications at weekly intervals, depending upon the treatment. Each time 10 kg N per hectare was sprayed using a foot-pump sprayer adjusted to a fine nozzle.

TABLE I
Pooled average of grain yield for two years 1968 and 1969

Variety	80% basal + 20% top dressed (Nitrogen in kg/ha)				80% basal + 20% foliar (Nitrogen in kg/ha)			
	50	100	150	200	50	100	150	200
				Quintals per hectare				
IR-8 ..	54·8	63·0	65·8	63·9	59·7	67·0	64·5	65·5
IR-262 ..	60·1	65·0	68·3	66·8	65·1	70·2	65·9	66·1
Padma ..	54·0	59·1	63·9	60·9	56·9	63·6	59·7	60·4
NP 130 ..	38·2	39·4	37·5	31·7	41·1	37·7	33·5	29·2
Level × method mean	51·8	55·6	58·8	55·8	55·7	59·6	55·9	55·3
	C.D. at 5% level							
Between any two sub-plot treatment means	3·6							
Between nitrogen level × method means	1·7							

Statistical analysis of the data pooled over two years is presented in Table I.

There was a significant interaction between rates and methods of nitrogen application. For soil application, the highest yield, in general, was attained at 150 kg N/ha while the same yield was obtained by supplying only 100 kg N/ha partly through soil and partly through foliage.

Both IR-8 and IR-262 recorded the highest yield at 100 kg N/ha level of which 80 kg N was applied as basal dressing and 20 kg N as foliar spray of 3% urea solution at the panicle primordia initiation stage; the yield being 67·0 q and 70·2 q per hectare, respectively, for the two varieties. The corresponding yields at the same level, where the basal and second split doses were applied through soil, were 63·0 q and 65·0 q per hectare, respectively. The increases in yield due to foliar application were thus 4·0 q and 5·2 q per hectare, respectively, over the soil application method and these differences were statistically significant. For Padma, the increase in yield at 100 kg N/ha, due to foliar method of application, was 4·5 q per hectare more than the soil application method.

The data also revealed that part foliar application was effective in increasing yield only at the lower rates of nitrogen. At higher rates, the yield due to part foliar application was either at par or slightly less than the application of the fertilizer all through soil.

It is thus seen that foliar method of nitrogen application at panicle primordia initiation stage of rice crop increased the productive efficiency of the applied fertilizer. Such a method of fertilization may reduce the high fertilizer requirement of the high-yielding dwarf *indica* rice. This method of application enables attainment of the maximum yield potential of the variety at a considerably lower fertilizer dose and can thus lead to a saving of 40 to 50 kg of nitrogen per hectare, of that required for soil application.

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SOME NEW RECORDS OF RICE HOPPERS IN MAHARASHTRA

WITH the introduction of high-yielding varieties of paddy and change in cultivation practices, several problems have arisen which demand attention and investigation. Leaf and plant hoppers, which were hitherto considered as a pest of minor importance in the State of Maharashtra, have now become serious pests. In addition to their direct damage, they may pose a threat as carriers of virus diseases.

Khaire (1965) surveyed the drilled and transplanted paddy areas of Poona and Kolaba Districts of the State and reported eight species of rice leaf hoppers. During the course of this investigation, field as well as light trap sampling was carried out since the year 1966, and six new hoppers were recorded for the first time in the State.

A brief account of the hoppers is furnished in Table I.