Nitrogen dynamics and dry matter accumulation in rice (*Oryza sativa* L.) cultivars in different nitrogen levels under direct seeded and transplanting methods

P390

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The growing scarcity of worldwide water for agriculture is limiting the cultivation of flooded rice. This, combined with the shortage of land and labor resources, prompts farmers to adopt new methods of crop establishment. Direct-seeded rice (DSR) method is an emerging cultivation system with the advantage of easier and faster planting. It's easier because it requires less labor and promotes more efficient water use and it's faster because under DSR, crop maturity comes 10-12 days earlier than the average. Nitrogen fertilizer application is also widely adopted for enhancing grain production. The reported experiment was done to identify the most suitable rice genotype and nitrogen level combination under the transplanted and direct seeded rice systems. Grain and straw yields at harvest were reported in the companion poster P389, while the dynamics of plant nitrogen content and dry matter accumulation are discussed here.

Materials and methods

The field experiment was conducted on a deep black soil during the rainy season of 2013 at the Agricultural College Farm, Raichur, Karnataka, India. It was laid out in a split-split-plot design with three replications. The whole plots, comprised of the two establishment methods [transplanting (TPR) and direct seeded (DSR)], were each split into three subplots to which the varieties were randomly assigned [BPT 5204, Gangavathi sona, and JKPH 3333]. The variety subplots were further split into three subplots where the different nitrogen levels [75%, 100%, and 125% RDN per ha; 100% RDN is 150 kg/ha] were randomly assigned. The plants on both establishment methods were spaced at 25x10cm. Samples of plants from five hills per plot were collected weekly and separated into three sub-samples that were later weighed and analyzed for N content: blades, stems, and panicles. The weather condition of the site was sub-tropical with mean annual rainfall of 729 mm.

Nitrogen contents in different plant parts at harvest

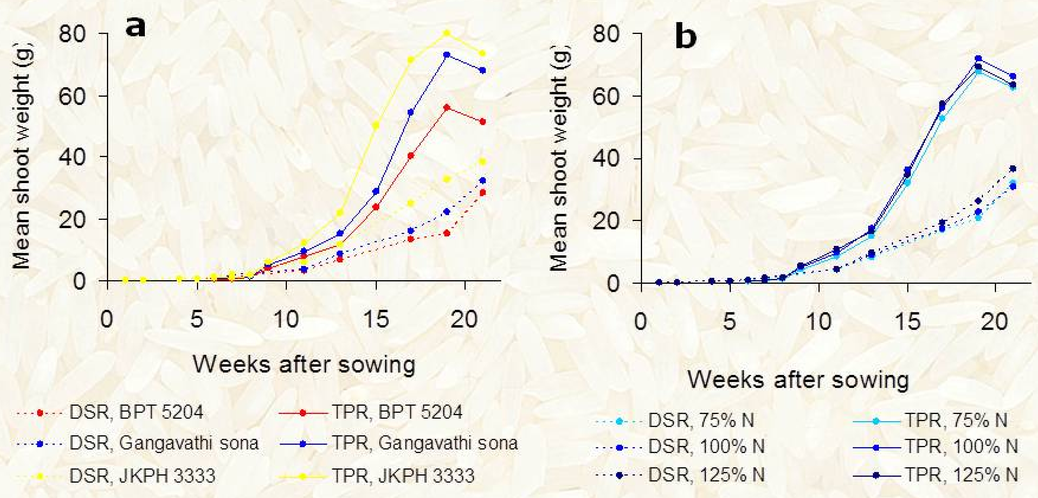
Treatment	Leaf (%)	Stem (%)	Grains (%)
Water management			
TPR	0.66	0.89	1.08
DSR	1.01	0.54	1.45
S.Em±	0.01	0.01	0.02
C.D. at 5%	0.03	0.05	0.06
Varieties (V)			
BPT-5204	0.57	0.77	0.80
Gangavathi sona	0.69	1.11	0.87
JKPH 3333	0.71	1.16	0.98
S.Em±	0.01	0.02	0.03
C.D. at 5%	0.04	0.05	0.08
Nitrogen levels (N)			
75% RDN	0.61	0.97	0.79
100% RDN	0.66	1.02	0.88
125% RDN	0.70	1.05	0.99
S.Em±	0.01	0.02	0.03
C.D. at 5%	0.04	0.05	0.08

Result and Discussion

At harvest, the N contents of above-ground parts (leaf, stem, and grain) were influenced by the crop establishment methods, the varieties, and the N fertilization. The leaf (1.01%) and grain (1.45%) N content were significantly higher under direct-seeding whereas the stem (0.89%) N content was higher under transplanting. As for varieties, the N content for the leaf (0.71%), stem (1.16%), and grain (0.98%) was consistently highest for the variety JKPH 3333 with Gangavathi sona in second place. Lastly, the N content was found to be consistently at maximum for each organ when treated with 125% RDN.

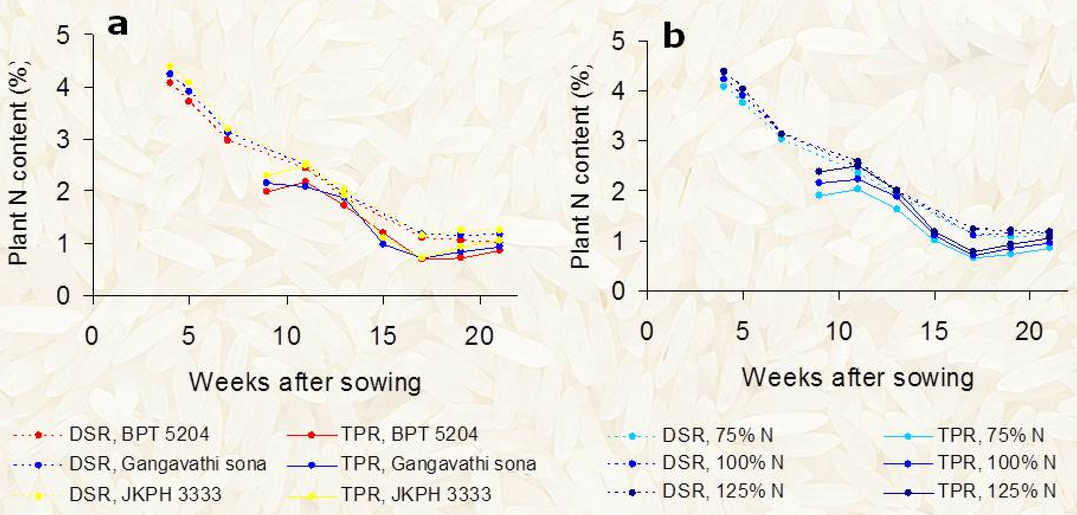
The higher leaf, stem and grain N content could be clearly related with higher grain and straw yields reported for JKPH 3333 variety, and 125% RDN fertilization in poster 389.

On the other hand, higher yield in transplanted plots were related with lower leaf and grain N content and higher stem N content. This indicates a strong effect of the cropping factor on the N partitioning or re-allocation.



Dynamics of the growth of the plant shoot weight influenced by the cropping method and (a) the variety and (b) the N fertilization

The strong reduction of the rate of plant biomass accumulation under DSR from week 13 onwards support that cropping method is the most influential factor in the growth of biomass. Next is the variety as shown by JKPH 3333 growing faster than others. N doses only played a marginal influence on the total biomass.



Dynamics of the plant N content influenced by the cropping method and (a) the variety and (b) the N fertilization

Like in biomass accumulation, cropping method was the factor that influenced the plant N content most. N plant content decreases faster in TPR plants due to the faster growth in biomass, as predicted by the known N dilution effect. Varieties showed small differences in plant N content although JKPH 3333 consistently has the highest. The N application rate influenced the plant N content more evidently around week 10 without any effect on the biomass accumulation.

Conclusions

Biomass accumulation was faster and yield was higher in TPR despite consistently lower plant N content compared to DSR. On the other hand, grain N content was much higher in TPR plants.

Among the varieties, JKPH-3333 showed a significantly higher N content in all the plant parts at harvest and during the whole crop duration.

As N application rates increased, the total N content in rice plants, whether under DSR or TPR, also increased significantly.

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