A field investigation was carried out at the 'C' Block Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal, during the kharif (wet) seasons of 1998 and 1999 in two sets. The soil of the experimental site was sandy clay loam having a pH of 7.5, total N 0.076 %, available P 15.87 kg ha\(^{-1}\) and available K 181.2 kg ha\(^{-1}\). The first experiment was conducted to study the effect of five levels of N, P\(_2\)O\(_5\) and K\(_2\)O (0 – 0 – 0, 30 – 15 – 15, 60 – 30 – 30, 90 – 45 – 45 and 120–60 – 60 kg ha\(^{-1}\)) on the performance of two hybrid cultivars (ProAgro 6201 and CNRH3) and one HYV (IET 4786) of rice (Oryza sativa L.) in factorial RBD in three replications. The second set of experiment was conducted to study the effect of three planting geometries (Farmer’s method of planting, 20 x 10 cm and 20 x 15 cm) and two directions of planting (North – south and East – west) on the performance of aforesaid hybrids and high yielding rice cultivars in Split–split plot design with three replications.

Plant height, root length, root volume, root DW and DM accumulation increased with the advancement of crop age terminating at the highest value at maturity while LAI, LAD, CGR and NAR increased up to 15 DAF and thereafter declined regardless of cultivars, fertility levels, spacings and directions of planting. The highest root : shoot ratio was recorded at 15 DAPI. However, root : shoot ratio decreased successively with the advancement of crop age.

The highest rate of increase in plant height and tiller number m\(^{-2}\) was occurred during AT – PI and AT stage, respectively. Maximum rate of increase in root length, root volume, root DW and root : shoot ratio took place during PI – 15 DAPI irrespective of cultivars, levels of fertility, spacings and directions of planting tried. The highest rate of increase in LAI and LAD was noticed during 15 DAPI – flowering and flowering – 15 DAF, respectively. The highest CGR and NAR was recorded during flowering - 15 DAF which resulted in the highest DM accumulation during the said stage regardless of cultivars, levels of fertility, spacings and directions of planting.

The hybrid ProAgro 6201 recorded the highest plant height, root length, root volume, root DM and total DM at maturity; the highest LAI at flowering or at 15 DAF and the highest LAD, CGR and NAR during flowering – 15 DAF. On the contrary, the HYV IET 4786 recorded the highest number of tillers m\(^{-2}\) at maturity and the highest root : shoot ratio at PI.
Plant height, tiller number m$^{-2}$, root length, root volume, root DM at all the stages of crop growth increased successively with each incremental dose of fertilizer terminating at the highest value at 120 – 60 – 60 kg N, P, K ha$^{-1}$. On the other hand, LAI, LAD and total DM accumulation and CGR increased with each additional dose of fertilizer terminating at the highest value at 120 – 60 – 60 kg N, P, K ha$^{-1}$ up to flowering. However, at 15 DAF and maturity, the highest values with respect to the aforesaid characters were recorded at 90-45-45 kg N, P, K ha$^{-1}$ which thereafter declined at 120-60-60 kg N, P, K ha$^{-1}$. Contrarily, NAR and root : shoot ratio increased successively with each additional dose of fertilizer reaching at the highest value at 90 – 45 – 45 kg N, P, K ha$^{-1}$ which then declined at 120 – 60 – 60 kg N, P, K ha$^{-1}$ at all the stages of crop growth.

Planting with farmers’ practice recorded the highest plant height, root length, root volume, tiller number at maturity, root : shoot ratio at 15 DAPI, LAR at PI and NAR during flowering – 15 DAF. But, root DM and total DM accumulation at maturity, LAI at flowering, LAD and CGR during flowering – 15 DAF was recorded to be the highest when the planting was done at the spacing of 20 x 10 cm.

North – south direction of planting recorded the highest LAI, LAD, total DM accumulation, CGR and NAR compared with the east-west direction of planting; however, both the directions of planting did not differ significantly with respect to plant height, tiller number m$^{-2}$, root length, root volume, root DM and root : shoot ratio.

Uptake of N, P and K both by grain and straw followed the trend as : ProAgro 6201 > CNRH3 > IET 4786 with the maximum uptake of N and P and the minimum uptake of K by grain. However, the uptake of N and P was minimum and uptake of K was maximum in case of straw. With regards to levels of fertility, uptake of N, P and K by the grain followed the trend as : 90 – 45 – 45 > 60 – 30 – 30 > 30 – 15 – 15 > 120 – 60 – 60 kg N, P, K ha$^{-1}$ > control while the uptake of N, P and K by the straw followed the trend as : 120 – 60 – 60 > 90 – 45 – 45 > 60 – 30 – 30 > 30 – 15 – 15 kg N, P, K ha$^{-1}$ > control with significant differences among them.

The hybrid ProAgro 6201 with the longest panicles, greatest panicle weight, highest grain number panicle$^{-1}$ and maximum test weight significantly recorded the highest grain yield (6.77 – 6.80 t ha$^{-1}$) and HI (47.22 – 47.64) at 90 – 45 – 45 kg N, P, K ha$^{-1}$ as compared to the highest grain yield (5.97 – 6.23) and HI (45.64 – 46.39) with CNRH3 at 90 – 45 – 45 kg N, P, K ha$^{-1}$ and the highest grain yield (4.82 – 5.13) and HI (47.37 – 47.77) with IET 4786 at 60 – 30 – 30 kg N, P, K ha$^{-1}$. The tallest
plants and the highest LAI with ProAgro 6201 produced maximum straw yield 
(7.48 – 7.70 t ha\(^{-1}\)) as compared to the straw yield recorded with CNRH 3 (7.36 – 
7.64) and IET 4786 (6.56 – 6.60) at 120 – 60 – 60 kg N, P, K ha\(^{-1}\). The hybrid 
ProAgro 6201 fetched the highest net profit to the tune of Rs. 12427 – 13055 ha\(^{-1}\) and 
benefit : cost ratio of 0.57 – 0.60 despite the highest cost of cultivation of Rs. 21807 – 
21973 ha\(^{-1}\) among the three cultivars. Grain yield, straw yield and HI due to different 
planting geometries and directions of planting did not differ significantly. On the 
average, maximum and optimum dose of N, P, K kg ha\(^{-1}\) were 86.4 – 43.2 – 42.3 and 
80.40 – 40.20 – 40.20 for ProAgro 6201 while that for CNRH3 were 72.00 – 36.00 – 
36.00 and 68.20 – 34.10 – 34.10 and for IET 4786 were 74.70 – 37.25 – 37.35 and 
69.30 – 34.65 – 34.65, respectively. The corresponding grain yield at maximum and 
optimum levels of N, P, K ha\(^{-1}\) were 6.42 and 6.41 t ha\(^{-1}\) for ProAgro 6201, 5.90 and 
5.92 t ha\(^{-1}\) for CNRH3 and 4.85 and 4.87 t ha\(^{-1}\) for IET 4786, respectively.

The cultivar ProAgro 6201 and IET 4786, endowed with long slender grains, 
found to be superior to CNRH3 (having medium slender grains) with respect to the 
percentage of head rice recovery. Both the hybrids ProAgro 6201 and CNRH3 
established superiority over the HYV IET 4786 with regard to protein content, 
volume of water uptake, volume expansion and elongation ratio, while IET 4786 
outperformed both ProAgro 6201 and CNRH3 with respective to amylose content, 
kernel length, kernel length after cooking. However, all the three cultivars possessed 
average white. Recovery of head rice, hulling and milling percentage were 
recorded to be the highest at 60 – 30 – 30 kg N, P and K ha\(^{-1}\). Protein content, 
however, was recorded to be the highest at 90 – 45 – 45 kg N, P and K ha\(^{-1}\).

Residual total N content in soil after the harvest of ProAgro 6201, CNRH3 and 
IET 4786 and at all the levels of fertility and residual available P content in soil, after 
the harvest of ProAgro 6201 and CNRH 3 and at all the levels of fertility except at 
120 – 60 – 60 kg N, P, K ha\(^{-1}\) declined. However, residual available P content, in soil 
after the harvest of IET 4786 and at 120 – 60 – 60 kg N, P, K ha\(^{-1}\) and residual 
available K content in soil after the harvest of ProAgro 6201, CNRH3 and IET 4786 
and at all the levels of fertility except at control increased as compared to the initial 
total N, available P and K content in soil, respectively.