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Results of Destructive Analysis in Developed Rice Genotypes

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A B S T R A C T

An experiment was conducted to study results of destructive analysis in developed rice varieties during *Rabi* 2014-15.Results showed that leaf area measurement, dry matter and root parameters like root length, root volume and root weight were highest in the variety RNR 15038 respectively and lowest in Swarna, HR-12 and TN-1. There was significant positive correlation between tiller number and root parameters with grain yield and maximum leaf area found in the variety RNR 15038 and minimum was recorded by the Variety Swarna Thus the highest dry matter production was recorded in variety RNR 15038 while minimum dry matter production was recorded for the variety Rajendranagar.

Introduction

Rice (*Oryza sativa* L.) is one of the most important cereal crops of family Poaceae. It is the staple food crop of 60 per cent of the world's population. The edible uses of rice include rice flakes, puffed rice and canned rice. Itis also used in starch and brewing industries. By products of rice milling *i.e.*, rice husk and bran are used as cattle and poultry feed. Rice is one of the diverse crop grow in different agro-climatic conditions and it is the second largest produced cereal in the world. More than 90 percent of the world's rice area is in Asia, which is the home for more than half of world's poor and more than half of world's rice cultivators (Rao *et al.*, 2010).

India is the second largest producer and consumer of rice in the world. Its production in India crossed the mark of 100 million tons in 2011-12 accounting for 22.81% of global production in that year. The productivity of rice has increased from 1984 kg /ha in 2004-05 to 2372 kg / ha in 2011-12. Rice is grown in an area of 44.8m ha with the production and productivity levels of 99.18mtones and

2214kg/ha, respectively in India. In Andhra Pradesh rice is grown in an area of 43.75 lakh ha with the production and productivity levels of 142.1 lakh tones and 3248 kg/ha (Anonymous, 2011). In crop improvement programs, continues efforts were on going in development of high yielding improved new varieties and management practices aiming at rice productivity.

Among the rice genotypes cultivated in our country, the developed rice varieties are popular over the recent year. These rice varieties are essential and to have throughout knowledge on physiological parameters in view of this experiment was conducted to study the dry matter, Leaf area measurement and root parameters.

Materials and Methods

An experiment was conducted during *rabi* season 2014-15 at Student Farm, College on Agriculture, Rajendranagar, Hyderabad, with eleven rice genotypes.

The experiment was laid out by following randomized block design with three replications. 30days of old nursery was transplanted by following a spacing of 15 × 15 cm. Nitrogen, phosphorus and potassium were applied at the rate 100:60:40 N, P_2O_5, K_2O Kg ha^{-1} in the form of urea, SSP and MOP. Scheduled irrigation and weed management practices were followed later harvesting were done. Destructive samplings were done at fort night interval by uprooting five hill per plot. Leaf area was measuring by using LI-3100 leaf area meter (LICOR Lincoln, Nebraska, USA). Dry matter of the component parts was recorded by subjecting the sample at 700C temperature in hot air oven till constant weight was obtained. After complete drying, dry matter was expressed in gm^{-2}.Root length was measured using a standard scale from the ground level to the tip of the root. Root volume was measured by water displacement method by dipping the properly washed root in a 1000 ml measuring cylinder containing water up to a certain point. Root volume was determined by displaced water (in ml) in the cylinder after root dipping. Mean of five values was obtained and expressed as root length and volume per hill respectively.

Results and Discussion

Total dry matter (g m^{-2}) for rice genotypes presented in table 1 and depicted in figure 1 have shown significant difference among all the rice genotypes from 30 DAT to maturity. There was a steady increase in total dry matter production in all the stages till maturity. The highest dry matter production of 1707 g m^{-2} was recorded in genotype RNR 15038 while minimum dry matter production of 1296 g m^{-2} was recorded for the genotype Rajendra at 90 DAT. The highest dry matter production in genotype RNR 15038 than in other genotype can be attributed to more LAI, LAD and better crop growth rates recorded with this genotype. Similar results were also reported by Chandrashekar *et al.,* (2001), Sinha *et al.,* (2009) and Wu Gui *et al.,* (2010).

Present study confirms the views of Venkateshwarulu and Prasad (1982) that the plant with greater dry matter accumulation could be expected to have a greater seed yield for plant as production of total dry matter is the prerequisite seed yield. Results showed that there was comparatively higher dry matter production after heading that conforms the study of Weng *et al.,* (1984).

Data on leaf area index (LAI) for all rice genotypes are presented in table 1 and depicted in figure 2. A significant variation was observed in LAI among rice genotypes from 30 DAT to maturity. These variations could be ascribed to genetic, climatic, and nutritional factor as supported by Venkateshwarulu and Maduley (1976) and this study also conformed the result of Shahidullah *et al.,* (2009) who stated that different rice genotypes exhibited significant variations for leaf area index (LAI).

It was observed that LAI increased from 15 DAT to 60 DAT behind which declined sharply and similar results were also found by Shiv kumar and Haloi (2001) and Chandrashekar *et al.,* (2001). Maximum leaf area index of 7.12 was reported in genotype RNR 15038 and minimum of 3.71 was reported with NLR 34449 at 60 DAT.

The decreased in the leaf area index towards maturity may be due to lesser number of leaves as a result of senescence of older leaves. In rice, yield increased with increase in LAI (Pinheiro and Guimaraes, 1990., Sahoo and Guru, 1998).

There was significant variation for root length among the tested genotypes of developed rice. Root length increased gradually up to 75 DAT after that the increase was very negligible. (Table 3 and figure 3). Maximum root length of 31.6 cm in genotype RNR 15038 and minimum of 18.5 cm were recorded genotype Swarna respectively at 90 DAT.

Table.1 Total dry matter productive (g m^{-2}) at different growth stages in rice genotypes during *rabi* season

S.No	Genotypes	Days after transplanting					
		15	30	45	60	75	90
1	Tellahamsa	84	311	555	1011	1371	1476
2	KNR-118	63	265	514	986	1304	1450
3	TN-1	63	262	505	906	1273	1429
4	JGL 11118	74	322	585	1101	1485	1654
5	RNR 15048	56	264	571	1067	1474	1626
6	Swarna	80	231	490	970	1248	1359
7	MTU 1010	77	312	587	1079	1427	1593
8	RNR 15038	58	308	609	1129	1495	1707
9	HR 12	76	294	452	890	1153	1301
10	NLR 34449	72	243	481	831	1211	1345
11	Rajendra	65	267	527	937	1201	1296
	SE ±	3.20	2.17	5.18	9.46	20.66	22.6
	C.D.	NS	18.14	15.30	54.62	61.40	84.05

Table.2 Leaf area index (LAI) at different growth stages in rice genotypes during *rabi* season

S.No	Genotypes	Days after transplanting					
		15	**30**	**45**	**60**	**75**	**90**
1	Tellahamsa	0.36	4.06	4.61	5.03	2.81	1.35
2	KNR-118	0.28	2.18	5.29	5.77	4.81	2.04
3	TN-1	0.35	2.20	4.80	5.15	2.22	1.45
4	JGL 11118	0.27	2.64	4.39	4.78	3.58	1.88
5	RNR 15048	0.27	2.80	5.49	6.16	4.54	2.27
6	Swarna	0.34	4.13	4.67	5.10	2.89	1.36
7	MTU 1010	0.28	2.21	5.72	5.78	4.65	2.79
8	RNR 15038	0.31	2.26	6.56	7.12	4.99	2.28
9	HR 12	0.35	2.32	4.52	5.02	4.27	1.64
10	NLR 34449	0.30	2.30	3.61	3.71	2.39	1.45
11	Rajendra	0.40	3.61	4.89	5.37	3.06	1.43
	SE ±	**0.01**	**0.03**	**0.10**	**0.13**	**0.03**	**0.02**
	C.D.	**NS**	**NS**	**0.30**	**0.42**	**0.31**	**NS**

Table.3 Root length (cm) at different growth stages in rice genotypes during *rabi* season

S.N0	Genotypes	Days after transplanting					
		15	**30**	**45**	**60**	**75**	**90**
1	Tellahamsa	13.3	24.4	26.5	28.6	28.4	28.9
2	KNR-118	12.6	20.8	22.3	25.3	25.3	25.4
3	TN-1	12.5	23.6	25.5	29.2	29.3	29.4
4	JGL 11118	14.76	24.1	26.1	30.2	30.3	33.7
5	RNR 15048	17.02	25.3	28.4	31.4	31.5	31.6
6	Swarna	10.1	15.2	17.9	18.3	18.4	18.5
7	MTU 1010	13.2	25.8	27.4	29.3	29.4	29.5
8	RNR 15038	18.4	27.2	29.6	32.5	31.6	32.7
9	HR 12	13.4	22.6	24.5	28.5	28.6	28.7
10	NLR 34449	12.6	23.3	24.3	26.5	26.3	26.6
11	Rajendra	12.26	20.5	23.1	24.5	24.6	24.7
	SE ±	**0.28**	**0.29**	**0.30**	**0.32**	**1.08**	**0.32**
	C.D.	**0.83**	**0.85**	**0.90**	**0.95**	**3.19**	**0.95**

Table.4 Root volume (RV) (ml hill^{-1}) at different growth stages in rice genotypes during *rabi* season

S.N0	Genotypes	Days after transplanting				
		30	**45**	**60**	**75**	**90**
1	Tellahamsa	21.7	22.9	26.5	27.4	21.6
2	KNR-118	19.4	22.8	26.6	28.1	24.6
3	TN-1	12.2	17.5	22.4	22.6	20.8
4	JGL 11118	17.3	21.8	30.3	31.2	25.4
5	RNR 15048	18.2	22.8	31.7	31.3	26.5
6	Swarna	13.2	17.9	22.3	23.4	21.3
7	MTU 1010	18.4	21.7	28.3	30.6	23.4
8	RNR 15038	24.2	26.4	33.2	32.7	27.7
9	HR 12	10.2	16.2	20.1	21.4	20.5
10	NLR 34449	15.4	21.60	27.9	26.2	22.8
11	Rajendra	15.1	20.16	26.5	25.6	21.9
	SE ±	**0.63**	**0.71**	**1.18**	**1.02**	**0.69**
	C.D.	**1.87**	**2.11**	**3.49**	**3.0**	**2.06**

Table.5 Root weight (g hill^{-1}) at different growth stages in rice genotypes during *rabi* season

S.N0	Genotypes	Days after transplanting					
		15	**30**	**45**	**60**	**75**	**90**
1	Tellahamsa	0.16	0.38	2.19	4.22	4.35	5.32
2	KNR-118	0.14	0.35	0.89	2.46	3.26	3.45
3	TN-1	0.18	0.65	1.22	1.84	2.15	2.21
4	JGL 11118	0.20	0.71	1.10	2.11	2.21	2.39
5	RNR 15048	0.12	2.21	2.98	4.32	5.23	5.34
6	Swarna	0.13	0.65	1.85	2.54	2.93	3.09
7	MTU 1010	0.38	1.89	3.12	4.71	5.45	5.37
8	RNR 15038	0.79	2.26	3.73	5.31	5.56	6.03
9	HR 12	0.54	1.18	1.56	2.28	2.68	2.87
10	NLR 34449	0.30	0.97	1.38	2.20	2.29	2.47
11	Rajendra	0.89	1.35	2.62	3.12	3.22	3.38
	SE ±	**0.03**	**0.01**	**0.02**	**0.03**	**0.05**	**0.15**
	C.D.	**0.11**	**0.06**	**0.11**	**0.23**	**0.17**	**0.46**

Fig.1 Total dry matter production at different growth stages in rice genotypes during *rabi* season

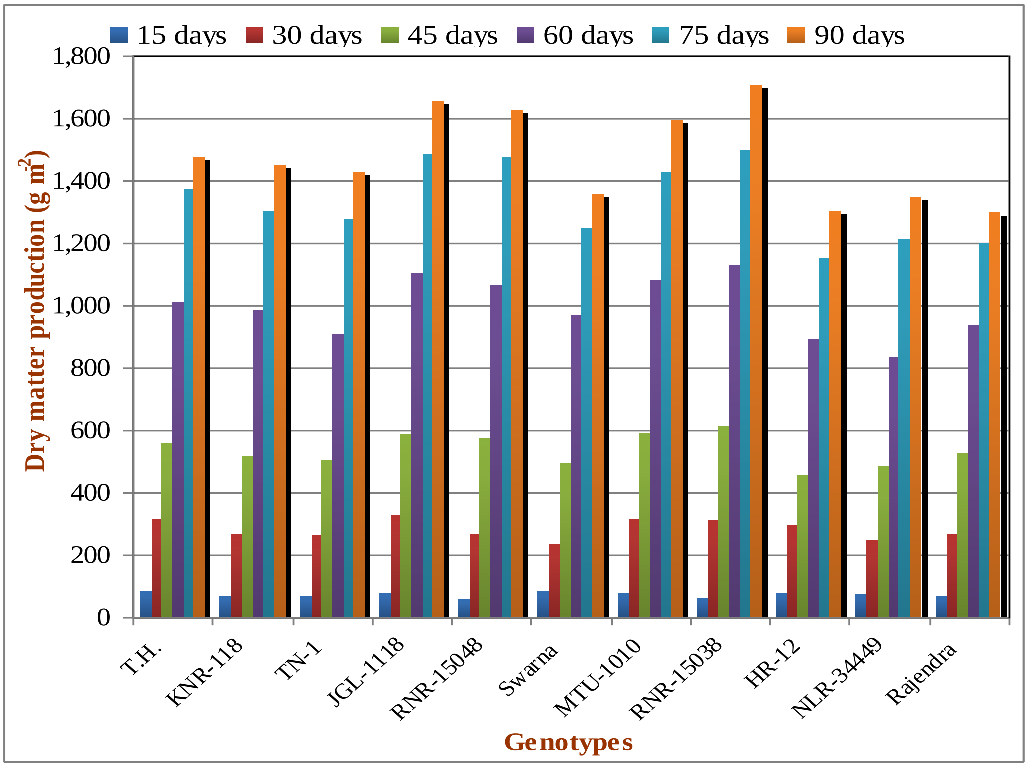


Fig.2 Leaf area index at different growth stages in rice genotypes during *rabi* season

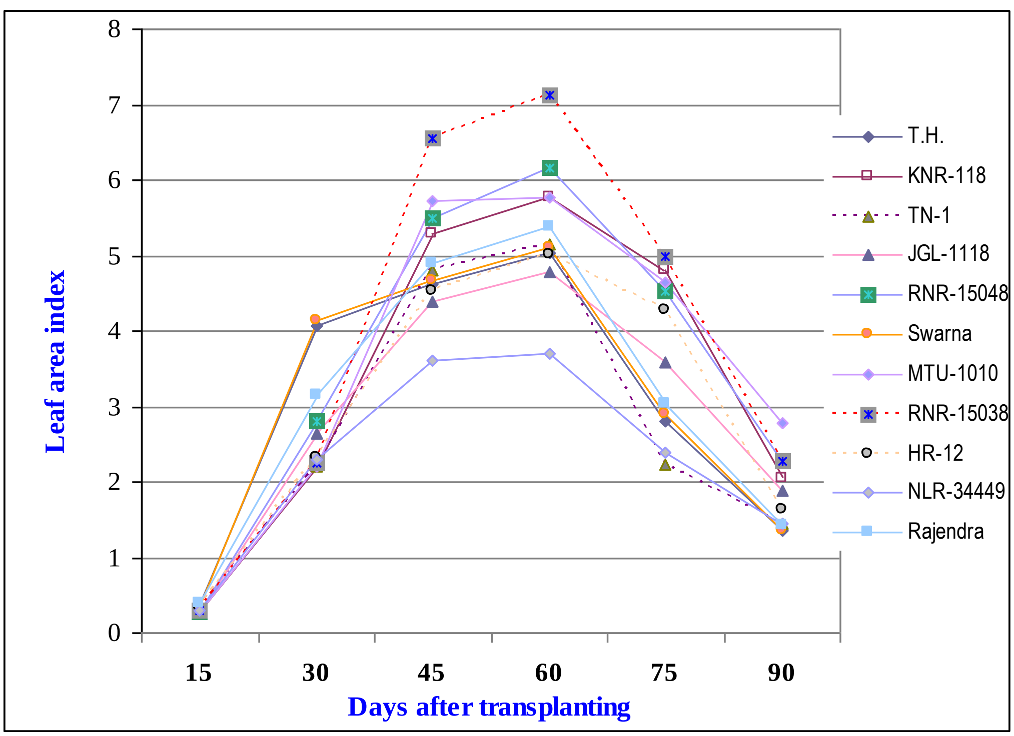


Fig.3 Root length at different growth stages in rice genotypes during *rabi* season

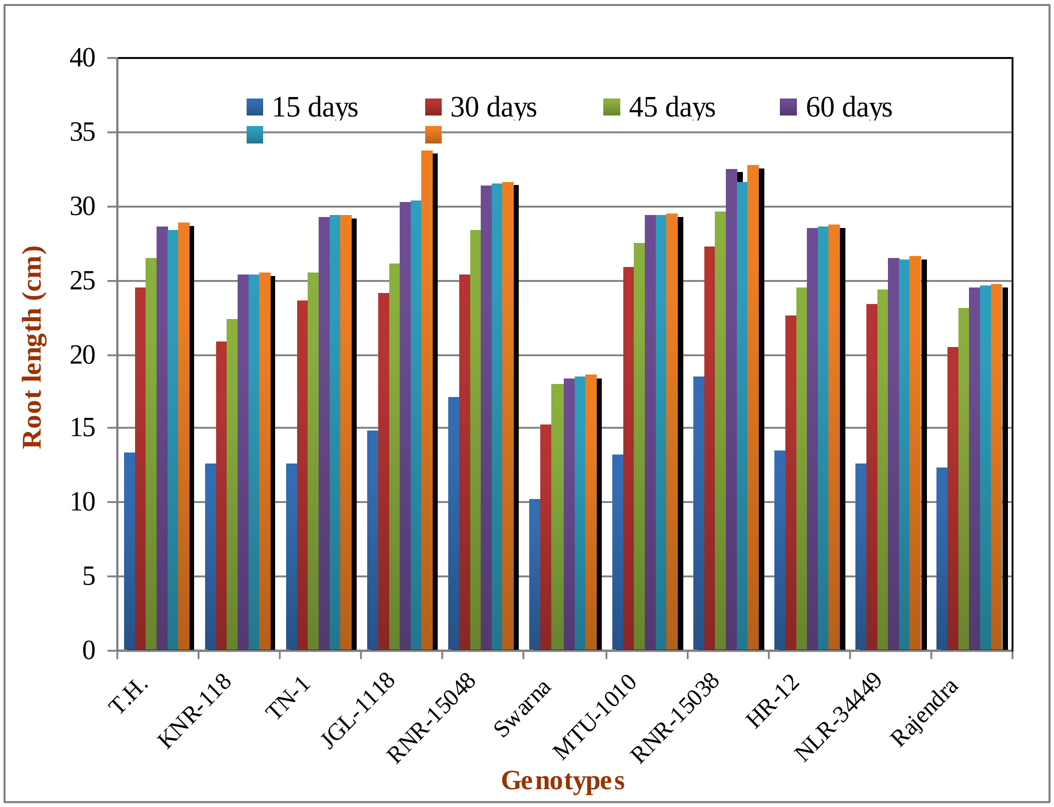


Fig.4 Root volume at different growth stages in rice genotypes during rabi season

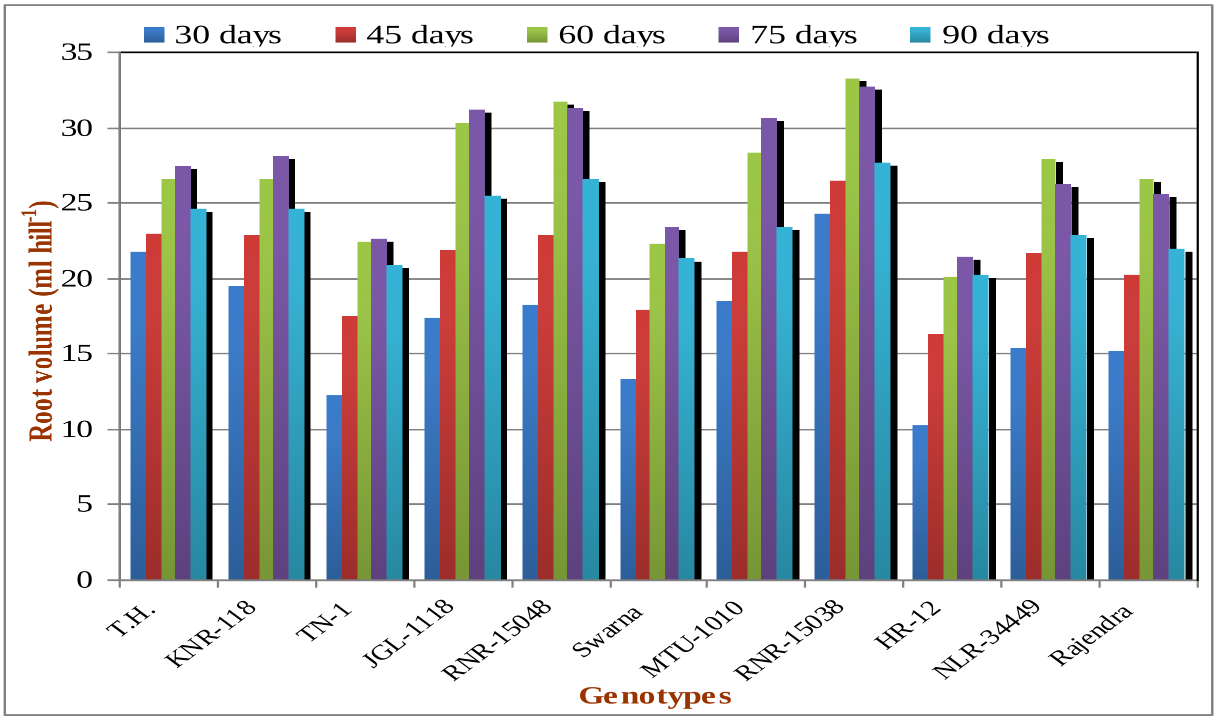
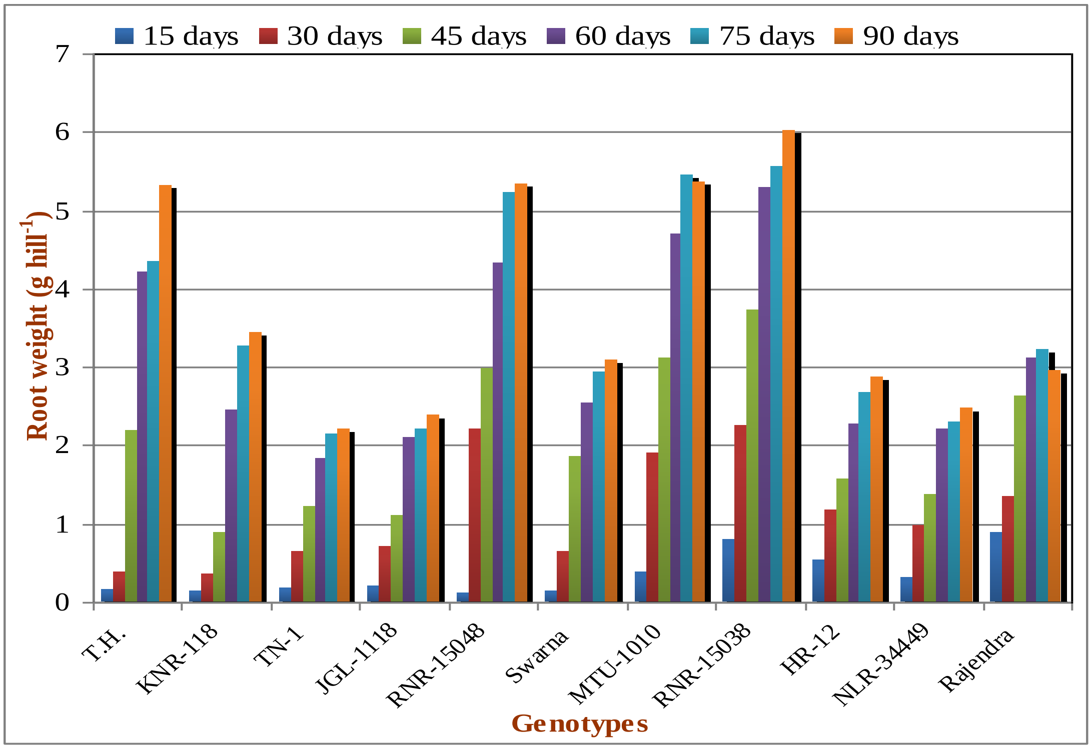


Fig.5 Root weight at different growth stages in rice genotypes during rabi season



Similar results were reported by Rajesh *et al.*, (2008). They further showed that higher root length positively associated with grain yield and dry matter protection. Kanbar *et al.*, (2009) revealed that root to shoot length ratios had large effect on shoot dry weight and grain yield under well-watered condition.

Root volume showed significant variation among genotypes at 30, 60 and 90 DAT. The progressive increase was noticed in root volume in all the genotypes up to 60 DAT thereby declined till maturity (Table 4 and figure 4). Maximum root volume of 33.2 ml $hill^{-1}$ was recorded in RNR 15038 at 60 DAT and minimum of 20.1ml $hill^{-1}$ was observed in genotype HR-12 among the stages analysed and among the genotypes studied. Root volume and root weight determined the ability of a plant to exploit the resources such as nutrient supply, moisture etc. so contributed to the grain yield and total dry matter production was reported by Rajesh *et al.*, (2008). Similarly Zuno-Altoverso *et al.*, (1990) found that root volume was significantly and positively correlated with both root length and root weight.

Data on root dry weight are presented in table 5 and depicted in figure 5. Root dry weight showed significant variation among the aromatic genotypes from 30 DAT to maturity. There was progressive increase in root weight among all the genotype up to 60 DAT thereafter declined till maturity. Maximum root dry weight of 5.36g hill was recorded in RNR 15038 And minimum root dry weight of 1.83 g hill was observed in TN-1 at 60 DAT. Genotypes with better developed roots, particularly with advantageous root morphology such as higher root weight with greater root volume together with increased root length enable nutrients acquisition from deeper soil depth hence increase the yield. Positive correlation between the root weight and grain yield and dry matter production was also reported by Rajesh *et al.*, (2008), Kanber *et al.*, (2009) and Fan JianBo *et al.*, (2010).

Based on the above results it is concluded that, significant variation was observed for root length, root volume and weight among the rice genotypes studied. Root length increased gradually up to 75 DAT after that the increased was very negligible. Maximum root length was recorded in variety 15038 throughout the crop growth and minimum in variety swarna. Root volume and weight increased up to 60 DAT thereafter declined till maturity. Maximum root volume and root weight was recorded in RNR 15038 at all growth stages and minimum was HR-12. There was positive association between high root volume and root weight with grain yield and dry matter production. There was a significant increase in total dry weight in all stages till maturity. The highest dry matter production was recorded in variety RNR 15038 while minimum was recorded in variety Rajendra. LAI increased from 15 DAT to 60 DAT and later on declined. Variest variation in leaf area index

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