

CHANGES IN THE ROOT SYSTEM OF RICE VARIETIES

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Abstract. *This study evaluated root system development in 12 rice accessions, including the standard variety UzROS-7/13, at four growth stages: emergence, tillering, stem elongation, and flowering. Root length varied among accessions and increased progressively throughout plant development. At emergence, root length ranged from 12 to 14 cm, increasing to 17–20 cm at tillering, 21–29 cm at stem elongation, and 29–38 cm at flowering. The Tarona accession demonstrated superior root development, reaching 29 cm at stem elongation and 38 cm at flowering. Accession 33-09 also reached 38 cm at flowering, whereas the standard variety UzROS-7/13 had the shortest root length at this stage (29 cm). The mean root length increased from 12.9 cm at emergence to 34.6 cm at flowering, representing an increase of 21.7 cm. These findings provide a basis for the preliminary evaluation of rice accessions according to root development and the selection of promising material for breeding programmes. Further studies are required to assess root biomass, root system volume, soil penetration depth, and the relationships between root traits and grain yield.*

Keywords: *Rice, rice accessions, root system, root length, root system development, growth stages, Tarona, UzROS-7/13, plant breeding, varietal evaluation.*

Introduction. Rice has a fibrous root system that usually spreads to a depth of 20 cm in the soil and sometimes reaches 30 cm. A distinctive feature of the root system is aerenchyma tissue, which contains air-conducting spaces. Under flooded irrigation, rice roots cannot obtain oxygen directly from the soil; oxygen from the air enters the root aerenchyma through the stomata in the leaves and stems. As a result, both the rice roots and the surrounding soil are supplied with oxygen [1].

Climate change and anthropogenic factors pose serious threats to crop productivity and the sustainability of agriculture. Therefore, improving plant tolerance to adverse conditions and using available resources efficiently are important objectives. Plants absorb water and nutrients from the rhizosphere mainly through their root systems [3]. Expanding the active surface area of the root system improves water and nutrient uptake. Accordingly, improving root system architecture (RSA) is an important factor in enhancing plant growth, productivity, and tolerance to adverse conditions [2].

Materials and Methods. The study examined 12 rice accessions, including the standard variety UzROS-7/13, to assess root system development at four growth stages: emergence, tillering, stem elongation, and flowering. Root length was used as the primary assessment parameter and was expressed in centimetres (cm).

The measurements were compared among accessions at each developmental stage to identify differences in root growth and development. The data were analysed comparatively to determine changes in root length across the four growth stages and to identify accessions with comparatively well-developed root systems. Particular attention was given to the Tarona and 33-09 accessions, as well as the standard variety UzROS-7/13.

Results and Discussion. The study assessed the root-system length, expressed in centimetres, of 12 rice accessions, including the standard variety UzROS-7/13 and other accessions, at four plant-development stages: emergence, tillering, stem elongation, and flowering.

The data indicate that root-system development differed among rice accessions depending on their genotypic characteristics and the plant’s growth and development stage.

According to the table, root-system length increased in all accessions during the later stages of plant development. Root length ranged from 12–14 cm at emergence, 17–20 cm at tillering, 21–29 cm at stem elongation, and 29–38 cm at flowering. This indicates that the rice root system develops actively as the plant grows.

At emergence, the highest root length (14 cm) was recorded in accessions 1142-93, 205-01, and Tarona. Root length was 12 cm in the standard variety UzROS-7/13 and accessions 10-09, 327-01, and 105-13.

At tillering, the highest value (20 cm) was recorded in accessions 229-06 and Tarona. The lowest value, 17 cm, was recorded in UzROS-7/13, 1142-93, 33-09, 105-13, and 227-09.

At stem elongation, Tarona had the highest value at 29 cm, followed by accession 229-06 at 28 cm and accession 100-06 at 27 cm. The lowest value was 21 cm, recorded in accessions 10-09 and 33-09.

No.	Rice accession	Emergence	Tillering	Stem elongation	Flowering
1	UzROS-7/13 (st.)	12	17	23	29
2	10-09	12	18	21	30
3	1142-93	14	17	22	32
4	205-01	14	18	23	31
5	327-01	12	18	24	36
6	33-09	13	17	21	38
7	100-06	13	18	27	37
8	229-06	13	20	28	35
9	105-13	12	17	23	36
10	176-09	13	18	26	37
11	227-09	13	17	25	36
12	Tarona	14	20	29	38

At flowering, the greatest root length (38 cm) was recorded in accessions 33-09 and Tarona. The lowest value, 29 cm, was recorded in the standard variety UzROS-7/13.

A comparative assessment of the table data identified the following characteristics: Tarona was among the accessions with the strongest root-system development.

Its root length was 14 cm at emergence, 20 cm at tillering, 29 cm at stem elongation, and 38 cm at flowering. This accession had the highest value at stem elongation and matched accession 33-09 at flowering.

Root length in accession 33-09 reached 38 cm at flowering. Its root length was 21 cm at stem elongation and increased by 17 cm by flowering. Root-system development in this accession was particularly rapid between stem elongation and flowering.

Accession 229-06 was notable for root lengths of 20 cm at tillering, 28 cm at stem elongation, and 35 cm at flowering. These results indicate active root-system development in this accession during the vegetative growth stages.

The standard variety UzROS-7/13 had the shortest root length in the table at flowering, at 29 cm. Other accessions had greater root lengths. However, root length alone is insufficient to draw firm conclusions about a variety's overall yield potential or drought tolerance.

The mean values calculated from the 12 accessions show that root-system length increased steadily from emergence to flowering. The mean was 12.9 cm at emergence and reached 34.6 cm at flowering, an increase of 21.7 cm.

Conclusion. The results showed differences among rice accessions in root-system length.

The most rapid root-system development occurred between the stem-elongation and flowering stages. Taronia had high values at tillering and stem elongation, while accessions 33-09 and Taronia had the highest values at flowering. These results can be used for preliminary assessment of rice accessions based on root-system development and for selecting promising material in breeding programmes. However, further research is needed to determine root-system volume, root biomass, penetration into deeper soil layers, and the relationship between these traits and yield.

References

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