

Assessment of Phenology and Productivity of Dual-Purpose Barley Varieties as Affected by Sowing Time and Fodder Harvesting Date

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Abstract

For assessing the growth and yield of dual-purpose barley, a field experiment was conducted during two consecutive *Rabi* season to evaluate the green fodder and grain yield of barley (*Hordeum vulgare* L.) varieties as affected by sowing time and stage of harvesting at the research farm of Forage Research and Management Centre, National Dairy Research Institute, Karnal. The field experiment was laid out in split-split plot design with four treatments of date of sowing (21st October, 31st October, 10th November and 20th November) in main plots, three varieties (RD-2552, RD-2035 and RD-2715) in sub plots and three stage of harvesting (45DAS, 55DAS and 65DAS) in sub-sub plots with three replications. Green fodder and dry matter yield was the highest on 10th November (18.47 t ha⁻¹, 2.17 t ha⁻¹) sowing, variety RD-2715 (17.6 t ha⁻¹, 2.06 t ha⁻¹) and harvesting of fodder at 65 DAS (25.06 t ha⁻¹, 2.98 t ha⁻¹). Grain yield was the highest on 21st October (3.82 t ha⁻¹) sowing date, variety RD 2552 (3.66 t ha⁻¹) and harvesting of fodder at 45 DAS (3.68 t ha⁻¹).

Keywords: Dry matter, Fodder yield, Grain yield, Livestock, Spike, Test weight, Tillers

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1. Introduction

The 20th Livestock Census report indicates that India's total livestock population stands at 535.78 million, marking a 4.6% increase compared to the 2012 census (Anonymous, 2020). While green fodder is essential for milk production, the area allocated for fodder cultivation is significantly lower than what is needed, and it continues to decrease over time (Kaith *et al.*, 2024). According to IGFRI Vision 2050, India faces a shortfall of 35.6% in green fodder, 10.9% in dry fodder, and 44% in feed. Furthermore, 90% of the livestock diet in India consists of low-quality roughages (Maneesha *et al.*, 2024). To address the green fodder shortage, it is crucial to derive a portion of it from primary food crops, which can be achieved by using dual-purpose crops like barley. Barley (*Hordeum vulgare* L.) is one of the World's most significant cereal crops, ranking fourth globally after wheat, rice and maize (Baik and Ullrich, 2008) whereas in India it ranks after rice and wheat. It

contributes approximately 7% to global cereal production (Pal *et al.*, 2012). Barley grain is primarily used as animal feed worldwide, and in India, a substantial portion is utilized either alone or in combination with other feeds. As a fodder crop, barley exhibits excellent potential due to its ability to produce a high yield of digestible dry matter and protein per hectare. It is highly adaptable and can thrive across a wide range of climatic conditions, more so than any other cereal crop. Historically, barley has evolved from being primarily a food grain serving as a key feed and malting grain (Pourkheirandish and Komatsuda, 2007). In India, it is an important coarse cereal cultivated during the *rabi* (winter) season, predominantly in the northern plains and hilly regions. Rajasthan leads in both area under cultivation (0.223 million hectares) and total production (0.620 million tonnes), whereas Uttar Pradesh has the highest productivity at 3.357 tonnes per hectare. Dual-purpose barley serves



as an excellent alternative fodder crop due to its vigorous vegetative growth and remarkable regeneration ability, even under limited input conditions. Factors such as late harvesting of preceding crops, excessive soil moisture following the rainy season, and increasing cropping intensity have led to a significant portion of barley being sown under moderate to late planting conditions. Late-sown barley often encounters low temperatures during the vegetative stage, which can hinder physiological processes, including root development, and nutrient as well as water uptake. Conversely, during reproductive stages, high temperatures can reduce grain growth, ultimately affecting crop yield. Optimizing planting time to align with prevailing weather conditions is crucial for maximizing barley yield. Sowing too early can expose the crop to high temperatures during the tillering stage, while late planting may lead to lower biomass and poor grain development due to high temperatures at maturity. Additionally, the stage at which barley is harvested significantly influences both fodder yield and quality. Harvesting time affects the chemical composition of fodder, total dry matter yield, and the crop's regeneration capacity, which in turn impacts grain yield. In the present stage there is limited information on the appropriate barley varieties, optimal sowing dates, and ideal harvesting stages for the Karnal (Haryana) region. Considering these aspects, the present study was conducted to evaluate the performance of different barley varieties under varying sowing dates and harvesting stages.

2. Materials and Methods

A field experiment was carried out over two consecutive Rabi seasons at the Research Farm of the Forage Research and Management Centre, National Dairy Research Institute, located in Karnal, Haryana. Karnal, positioned at a latitude of 29°43' N and a longitude of 76°58' E, with an altitude of 245 meters above mean sea level (MSL). The soil at the experimental site was sandy loam in texture, with low available nitrogen, medium available phosphorus, high available potassium, and a neutral pH.

2.1. Experimental details

The field experiment was laid out in split-split-plot design with four treatments of date of sowing (21st October (D1), 31st October (D2), 10th November (D3) and 20th November (D4)) in main plots, three varieties (RD-2552, RD-2035 and RD-2715) in sub plots and three periods of harvesting (45 DAS (H1), 55 DAS (H2) and 65 DAS (H3)) in sub-sub

plots with three replications with total 108 numbers of plots. The seed rate was 100 kg/ha at 22 cm row to row distance in plot size of 5.0 mx3.0 m.

2.2 Cultural practices

The field was prepared using a tractor-drawn cultivator and disc harrow, followed by planking to achieve the proper soil tilth. A basal dose of 60 kg P₂O₅ and 30 kg K₂O per hectare was applied at sowing, using SSP and MOP, respectively. Nitrogen, at 80 kg per hectare, was applied in three split doses: half at sowing and the remainder in two equal splits at 25 DAS and just after cutting for fodder. Sowing involved three barley varieties (RD2552, RD2035, RD2715) across four dates. Manual weeding was done at 25 DAS, and three irrigations were given at 21, 48, and 55-65 days after sowing depending upon fodder harvesting. Barley was harvested for fodder at 45, 55, and 65 DAS, with final grain harvesting after maturity.

2.3. Biometric observations

2.3.1. Growth attributes

Plant height was measured from ten randomly tagged plants in the central rows of each plot at 45, 55, and 65 DAS, from ground level to the tip. The mean height was calculated by averaging these ten measurements. The number of fully opened leaves per plant was recorded for the same ten tagged plants, and the average was determined. Leaf width was measured at the middle of the leaf blade, and leaf length was recorded from the longest leaf of the same ten plants, with averages calculated for both.

2.3.2. Yield attributes and yield

Effective tillers were counted from a 1-meter row length at five different spots in each plot and averaged to determine the number of tillers per meter. Spike length was measured from the base to the top of the spikelet on ten plants per plot, and the average was calculated. The number of grains per spikelet was determined by counting grains on ten spikes and averaging the results. For test weight, 1,000 grains from each plot were weighed. Grain yield was recorded by threshing the grains from each plot and converted to tonnes per hectare through calculations. Straw yield was determined by subtracting the grain yield from the total biomass yield after harvesting, and then converting the result to tonnes per hectare. Green fodder yield was calculated based on the fresh weight of the harvested plants per plot, and expressed in quintals



per hectare. Dry fodder yield was obtained by multiplying the green fodder yield with dry matter content (%) of the green fodder.

2.4. Statistical analysis

Statistical analysis of the recorded data was done as per split-split plot design (Cochran and Cox 1957), using IRRISTATE 4.0 WINDOWS was analysed the experimental data for its test of significance.

3. Results and Discussion

3.1. Growth parameters

3.1.1. Plant height

An analysis of the data presented in Table 3.1 for 45, 55, and 65 DAS shows that sowing on November 10th resulted in significantly higher plant height compared to sowing on November 20th and October 21st, though, it was similar to the plant height observed at the October 31st sowing. Better plant height in the 10th November sowing date may be due to improved weather conditions, such as temperature, humidity and day length, which were more favorable for barley growth. These findings align with the research of Razzaque and Rafiquzzaman (2006) and Rashid *et al.* (2010), who also reported greater plant height in crops sown from late October to early November. Plant height was significantly influenced by different barley varieties. Among the three varieties studied, RD-2715 exhibited the greatest plant height, surpassing RD-2035 significantly and RD-2552 even more substantially. The variation in plant height across varieties can be attributed to genetic differences. Similar trends were observed in studies conducted by Kapoor *et al.* (2010) and Jain and Nagar (2010). Moreover, plant height increased with the crop's growth stage. The data indicate that barley harvested for fodder at 65 days after sowing (DAS) attained significantly greater height than plants harvested earlier. The plant height at 65 DAS was markedly higher than at 55 and 45 DAS. This increase in height can be attributed to the extended growth period available to the 65 days old plants compared to those harvested at 45 and 55 DAS.

3.1.2. Leaf length

The data shown in Table 3.1 revealed a significant variation in leaf length based on the sowing date. The highest leaf length was observed in the third sowing date (November 10th), which was comparable to the second (October 31st) and fourth (November 20th) sowing dates.

The lowest leaf length was recorded for the first sowing date (October 21st), which was similar to that of the fourth sowing date (November 20th). This outcome may be attributed to optimal temperature and favorable weather conditions supporting barley growth. These findings are in consistent with the studies of Singh *et al.* (1997) and Prasad *et al.* (1988). Barley leaf length was significantly influenced by variety. Among the three varieties, V3 (RD-2715) exhibited the longest leaves, while V2 (RD-2035) had an intermediate leaf length and significantly longer than V1 (RD-2552) but shorter than V3 (RD-2715). This variation in leaf length can be attributed to genetic differences among the varieties. The stage of harvesting also had a significant impact on leaf length. A detailed analysis of the data in Table 3.1 revealed that the longest leaves were observed in crops harvested at 55 days after sowing (DAS), which were significantly longer than those harvested at 65 DAS and 45 DAS. The shortest leaf length was recorded in crops harvested at 65 DAS.

3.1.3. Number of leaves per plant

An analysis of the data presented in Table 3.1 for the number of leaves per plant at 45 DAS, 55 DAS, and 65 DAS indicated a significant effect of the sowing date on leaf count. The highest number of leaves per plant was observed in the first sowing date (October 21st), which was similar to the second (October 31st) and third (November 10th) sowing dates but significantly greater than the number of leaves in the last sowing date (November 20th). The number of leaves per plant was influenced by different barley varieties. Variety V1 (RD-2552) exhibited significantly higher leaf count compared to V3 (RD-2715) and was statistically on par with V2 (RD-2035). The stage of harvesting also had a notable impact on the number of leaves per plant, as indicated by the data in Table 3.1. The highest leaf count was recorded at the third harvesting stage (65 DAS), which was significantly greater than at 55 DAS and 45 DAS. The lowest number of leaves was observed in plants harvested at 45 DAS. This increase in leaf count at 65 DAS may be attributed to the extended growth period, allowing plants to accumulate more growing degree days and develop a greater number of leaves.

3.1.4. Tillers per plant

The data presented in Table 3.1 showed a significant difference in the number of tillers per plant based on the



sowing date. The first sowing date (October 21st) and the second sowing date (October 31st) were similar in terms of tillers per plant, and both were significantly higher than the third (November 10th) and fourth (November 20th) sowing dates. The third and fourth sowing dates were comparable to each other. The highest number of tillers was observed in the first sowing date (October 21st), while the lowest was recorded in the fourth sowing date (November 20th). The reduction in tiller number may be attributed to delayed germination and slower growth due to lower temperatures at sowing under late-season conditions. The data presented in Table 3.1 indicate that the number of tillers per plant was influenced by different varieties, as reported by Supriya *et al.* (2024). Varieties V1 (RD-2552) and V2 (RD-2035) showed similar results and were significantly different from V3 (RD-2715) in terms of tiller production. The highest number of tillers per plant was observed in variety V1 (RD-2035), while V3 (RD-2715) produced the fewest. These differences can likely be attributed to the genetic characteristics of the varieties. Further, the stage of harvesting did not have a significant impact on the number of tillers per plant.

3.1.5. Leaf: stem ratio

The leaf-to-stem ratio is an important factor for assessing the palatability of fodder. The data presented in Table 3.1 indicated that the date of sowing, varieties, and stage of harvesting significantly affected the leaf-to-stem ratio. The highest leaf-to-stem ratio was observed in the first sowing date (October 21st), while the second (October 31st), third (November 10th), and fourth (November 20th) sowing dates were statistically similar to each other. The third sowing date (November 10th) had the lowest leaf-to-stem ratio. These variations can be attributed to differences in plant growth rates at different sowing times. Among the three varieties, V1 (RD-2552) exhibited the highest leaf-to-stem ratio, which was significantly higher than that of V3 (RD-2715) but comparable to V2 (RD-2035). V2 (RD-2035) and V3 (RD-2715) showed similar results, with V3 (RD-2715) having the lowest leaf-to-stem ratio. Similar trends were reported by Kapoor *et al.* (2010). The stage of harvesting had a significant influence on the leaf-to-stem ratio, with harvesting at 45 DAS showing a significantly higher ratio compared to harvesting at 55 DAS and 65 DAS. The lowest leaf-to-stem ratio was recorded at 65 DAS, which differed significantly from that at 55 DAS. This trend can

be attributed to crop growth patterns, as plants harvested at 45 DAS had a shorter growth period, leading to enhanced leafy growth compared to those harvested at 55 and 65 DAS, resulting in a higher leaf-to-stem ratio.

3.2. Yield attributes

3.2.1. Tillers per meter row length

The data presented in Table 3.1 show that the number of tillers per meter of row length was significantly influenced by the date of sowing. The second sowing date (October 31st) recorded the highest number of tillers per meter row length, which was statistically similar to the first sowing date (October 21st). The first (21st October), third (10th November), and fourth (20th November) sowing dates exhibited similar results in terms of tiller count per meter row length. However, the fourth sowing date (20th November) recorded the lowest number of tillers per meter row length among all sowing dates, likely due to the optimal sowing period for barley. The number of tillers per meter row length was significantly influenced by different barley varieties. Among the three, V1 (RD-2552) produced the highest tiller count per meter row length, with significantly greater values than V2 (RD-2035) and V3 (RD-2715). V3 (RD-2715) had the lowest tiller count. These differences can be attributed to the genetic variability of the varieties and the growing conditions of barley. The stage of harvesting did not impact the number of tillers per meter row length. As shown in Table 3.1, harvesting barley for fodder at 45 DAS resulted in the highest tiller count, whereas harvesting at 65 DAS recorded the lowest values.

3.2.2. Spike length

The data presented in Table 3.1 indicate that the date of sowing did not have a significant effect on spike length. The longest spike was produced by the November 10th sowing (8.84 cm), followed by the October 21st sowing (8.46 cm), October 31st sowing (8.45 cm), and November 20th sowing (8.43 cm). The findings align with those of Razzaque and Rafiquzzaman (2006). The data presented in Table 3.1 indicate a significant influence of variety on spike length, with V3 (RD-2715) exhibiting the longest spike, differing significantly from V2 (RD-2035) and V1 (RD-2552). Among the varieties, V1 recorded the highest spike length (10.36 cm), followed by V2 (8.21 cm) and V3 (7.37 cm). Analyzing the spike length data in Table 3.1 reveals that the stage of harvesting had no significant



impact. However, crops harvested at 65 DAS produced the longest spikes (8.74 cm), followed by those harvested at 55 DAS (8.60 cm) and 45 DAS (8.46 cm), respectively.

3.2.4. Test weight

An analysis of the data presented in Table 3.1 regarding test weight showed that it decreased with a delay in sowing. The first sowing date (October 21st) produced the highest test weight, which was similar to the second (October 31st) and third (November 10th) sowing dates, and significantly higher than the fourth sowing date (November 20th). The

third and fourth sowing dates were statistically similar, but the fourth sowing date had the lowest test weight. The data also indicated no significant difference in test weight among the three varieties. V2 (RD-2035) had the highest test weight, followed by V1 (RD-2552) and V3 (RD-2715). The stage of harvesting significantly influenced test weight, with a delay in the harvesting stage for green fodder resulting in a reduction in test weight. The highest test weight was recorded in the crop harvested at 45 DAS (36.39g), which was significantly higher than those harvested at 55 DAS (35.08g) and 65 DAS (34.39g).

Table 3.1. Effect of date of sowing, varieties and stage of harvesting on plant height, leaf length, leaf width (cm), number of leaves per plant, tillers/plant and leaf stem ratio, tillers per meter row length and spike length (cm), test weight (g) and number of grains/spikelet (Mean- 2Years)

Treatment	Plant height (cm)	Leaf length (cm)	No. of leaves per plant	No. of tillers per plant	Leaf: stem ratio	Tillers per meter row length	Spikelet length (cm)	Test weight (g)
Date of sowing								
D1 (21 st October)	60.45	34.49	39.52	10.14	1.82	88.22	8.44	36.66
D2 (31 st October)	68.24	37.33	37.14	9.52	1.39	97.28	8.41	36.21
D3 (10 th November)	68.73	37.31	32.06	7.93	1.18	84.24	8.8	34.89
D4 (20 th November)	63.27	36	31.64	7.3	1.42	80.46	8.4	33.23
SEm±	1.41	0.81	1.28	0.39	0.161	4.61	0.18	0.91
CD (P= 0.05)	3.47	1.99	3.13	0.95	0.394	11.29	NS	2.23
Varieties								
V1 (RD-2552)	59.35	34.18	38.8	9.67	1.66	111.3	7.34	35.29
V2 (RD-2035)	64.71	35.65	36.21	8.83	1.48	83.36	8.18	35.57
V3 (RD-2715)	71.45	39.03	30.27	7.67	1.22	67.97	10.02	34.36
SEm±	1.82	0.8	1.85	0.38	0.152	6.34	0.27	0.65
CD (P= 0.05)	3.98	1.74	4.04	0.84	0.332	13.82	0.59	NS
Stage of harvesting								
H1 (45DAS)	53.83	35.47	29.83	8.65	2.2	92.01	8.26	36.33
H2 (55DAS)	63.93	36.95	34.99	8.91	1.28	87.22	8.56	35.05
H3 (65DAS)	77.76	36.43	40.45	8.61	0.88	83.42	8.72	34.36
SEm±	0.925	0.39	1.42	0.453	0.168	5.48	0.2	0.1
CD (P= 0.05)	1.85	0.79	2.86	NS	0.337	NS	NS	0.2

3.3. Yield

3.3.1. Green fodder yield

The data presented in Table 3.2 show that the green fodder yield was significantly affected by the sowing date. The third sowing date (November 10th) produced the highest green fodder yield, which was statistically similar to the second sowing date (October 31st). The first (October 21st) and fourth (November 20th) sowing dates were comparable

in terms of green fodder yield but significantly lower than the second (October 31st) and third (November 10th) sowing dates. The lowest green fodder yield was observed in the fourth sowing date (November 20th). This result may be due to the optimal sowing time for the barley crop. The green fodder yield of barley was significantly influenced by the variety. V3 (RD-2715) produced the highest green fodder yield among the three varieties, while V2 (RD-2035) and V1 (RD-2552) were statistically similar. V1 (RD-2552) had



the lowest green fodder yield. These differences are likely attributed to the genetic variability of the varieties. The findings align with the studies by Sharma (2009), Hundal *et al.* (2014), and Kaur *et al.* (2009). The green fodder yield of barley increased with the advancement of the harvesting stage. According to the data, the green fodder yield from crops harvested at 65 DAS was significantly higher than at the other harvesting stages, with the lowest yield recorded at 45 DAS. The green fodder yield from crops harvested at 65 DAS was highly significant compared to those harvested at 55 and 45 DAS. The higher yield at 65 DAS can be attributed to the longer growth period available for the crop compared to the 45- and 55-day-old crops.

3.3.2. Dry matter yield

The data presented in Table 3.2 indicate that dry matter yield was significantly influenced by the sowing date. The third sowing date (November 10th) produced the highest dry matter yield, which was statistically similar to the second sowing date (October 31st). The first sowing date (October 21st) and the fourth sowing date (November 20th) were comparable in terms of dry matter yield, but significantly lower than the second and third sowing dates. Fourth (20th November) date of sowing was the lowest in dry matter yield among all dates of sowing. This result may be attributed to the optimal sowing time for the barley crop. The findings align with those of Alam *et al.* (2005) and Shaikh *et al.* (2004). The dry matter yield of barley was significantly influenced by the variety. V3 (RD-2715) produced the highest dry matter yield among the three varieties, while V2 (RD-2035) and V1 (RD-2552) were statistically similar. V1 (RD-2552) had the lowest dry matter yield. These differences are likely due to the genetic variability of the varieties and the environment. This is consistent with the findings of Chun *et al.* (2000). The dry matter yield of barley increased with the advancement of the harvesting stage. As per the data, harvesting barley plants for fodder at 65 DAS resulted in a significantly higher dry matter yield compared to other harvesting stages, with the lowest yield at 45 DAS. The dry matter yield of crops harvested at 65 DAS was highly significant compared to those harvested at 55 and 45 DAS. The higher dry matter yield at 65 DAS can be attributed to the longer growth duration available for the crop, compared to the 45- and 55-day-old crops. These findings are in consistent with those of Kaur *et al.* (2013).

3.3.3. Grain yield

A critical analysis of the data presented in Table 3.2 revealed a significant effect of sowing date, variety, and stage of harvesting on grain yield. The data showed that the first sowing date (October 21st) produced the highest grain yield, which was statistically similar to the second sowing date (October 31st) and significantly higher than the third (November 10th) and fourth (November 20th) sowing dates. The second and third sowing dates were statistically comparable to each other. Fourth (20th November) date of sowing produced lowest grain yield. This result may be attributed to the shorter growth period of the late-sown crop, which leads to lower assimilation. Analyzing the data in Table 3.2 regarding grain yield reveals significant differences among the varieties. V1 (RD-2552) produced the highest grain yield, which was similar to that of V2 (RD-2035) but significantly higher than V3 (RD-2715). V3 (RD-2715) had the lowest grain yield. The stage of harvesting significantly influenced grain yield, with a delay in harvesting for green fodder negatively affecting grain yield. The highest grain yield was recorded in crops harvested at 45 DAS (3.75 t/ha), which was significantly higher than that of crops harvested at 55 DAS (3.54 t/ha) and 65 DAS (2.66 t/ha). The lowest grain yield was observed in crops harvested at 65 DAS.

3.3.4. Straw yield

Perusal of data revealed that first (21st October) date of sowing produced highest straw yield among all dates of sowing which was statistically at par with second (31st October) date of sowing and significantly higher than third (10th November) and fourth (20th November) date of sowing. Second (31st October), third (10th November) and Fourth (20th November) date of sowing were statistically at par with each other. Fourth (20th November) date of sowing produced lowest straw yield. This result may be attributed to the shorter growth period of the late-sown crop. The data presented in Table 3.2 indicate a significant difference in straw yield among the varieties. V1 (RD-2552) produced the highest straw yield, which was similar to V2 (RD-2035) and significantly higher than V3 (RD-2715). V3 (RD-2715) produced the lowest straw yield. The stage of harvesting significantly influenced straw yield, with a delay in harvesting for green fodder negatively affecting the straw yield (Singh *et al.*, 2024). The highest straw yield was recorded in crops harvested



at 45 DAS (3.75 t/ha), which was significantly higher (2.66 t/ha). The lowest straw yield was observed in crops than those harvested at 55 DAS (3.54 t/ha) and 65 DAS harvested at 65 DAS.

Table 3.2. Effect of date of sowing, varieties and stage of harvesting on green fodder yield (t/ha), dry matter yield (t/ha), grain yield (t/ha) and straw yield (t/ha) (Mean- 2Years)

Treatment	Green fodder yield (t/ha)	Dry matter yield (t/ha)	Grain yield (t/ha)	Straw yield (t/ha)
Date of sowing				
D1 (21 st October)	14.11	1.65	3.82	4.71
D2 (31 st October)	18.30	2.12	3.31	4.12
D3 (10 th November)	18.47	2.17	3.02	4.38
D4 (20 th November)	13.44	1.64	2.39	3.82
SEm±	1.07	0.12	0.23	0.31
CD (P= 0.05)	2.62	0.30	0.57	0.76
Varieties				
V1 (RD-2552)	14.90	1.76	3.66	5.01
V2 (RD-2035)	15.74	1.85	3.53	4.72
V3 (RD-2715)	17.6	2.06	2.21	3.04
SEm±	0.50	0.07	0.22	0.28
CD (P= 0.05)	1.10	0.15	0.49	0.61
Stage of harvesting				
H1 (45DAS)	8.11	0.94	3.68	4.98
H2 (55DAS)	15.07	1.76	3.07	4.24
H3 (65DAS)	25.06	2.98	2.65	3.55
SEm±	0.57	0.07	0.08	0.15
CD (P= 0.05)	1.15	0.14	0.17	0.30

Conclusion

Based on the results of the experiment, it was concluded that the third sowing date (November 10th) produced the highest green fodder yield and dry matter yield, while the first sowing date (October 21st) recorded the highest grain yield, straw yield, test weight, leaf-to-stem ratio, and tillers per meter row length. Among the varieties, V3 (RD-2715) showed the highest green fodder yield, dry matter yield, spike length, plant height, leaf length, and leaf width, while V1 (RD-2552) excelled in grain yield, straw yield, tillers per meter row length, number of leaves per plant, and leaf-to-stem ratio. Harvesting at the 65 DAS stage resulted in the highest green fodder yield, dry matter yield, and plant height, while harvesting at 45 DAS produced the highest grain yield, straw yield, test weight, and leaf-to-stem ratio.

Authors' Contributions

All authors contributed to editing and approved the final manuscript.

Conflict of Interest

The authors declare that they do not have any conflict of interest.

Ethical Approval

The article doesn't contain any study involving ethical approval.

Generative AI or AI/Assisted Technologies use in Manuscript Preparation

No

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