The present investigation entitled "Mutation breeding for improvement in yield and nutrient contents in barley (Hordeum vulgare L.)" comprised 26 mutants, one standard variety and two mother cultivars with the objectives:-(i) to study the performance of different induced mutants, (ii) to identify the high yielding mutants, (iii) to estimate the nutrient contents in grains and forage of identified high yielding mutants and (iv) to identify high yielding and improved nutrient containing mutants.

The experimental materials were grown in a randomized block design with three replications during Rabi season of 2002-2003 and 2003-2004 at Crop Research Farm, Post Graduate College, Ghazipur. The plant-to-plant and row-to-row distance was kept 30 cm and 15 cm, respectively. All the recommended agronomical practices were adopted to ensure good performance of crop.

The salient findings from the present study are summarized as follows:

The analysis of variance showed that the mean squares due to treatments were highly significant at (1% level of significance) for all the sixteen quantitative characters of two years and pooled over years indicating the variation among the characters.
In I, II year and pooled over years all the mutants differed significantly among themselves regarding their characters.

Mutants KHA2-25 in I year, KHA3-6 in II year and mutants K40-55, K50-65, KHA3-6 in pooled over years were the earliest in maturity while mutant K40-37 in year I and K30-76 in year II and pooled over years both were the latest in maturity.

Mutant K50-11 in I year, KHA3-6 both in II year and pooled over years contained the maximum number of tillers and mutants K50-19 in I year, K50-13 in II year and K30-76 in pooled over years contained the minimum number of tillers.

Over all variety Jyoti in I year and pooled over years both and K555 in II year had the tallest plant and mutant K30-7 in I year and pooled over years both and K30-8 in II year had the shortest plant.

Mutant KHA2-25 in I year, mutant K30-7 both in II year and pooled over years contained the maximum leaf area while mutant K40-72 in I year and pooled over years both and K50-72 in II year contained the minimum leaf area.

The highest length of spike with awn was contained by standard variety Jyoti in I, II year and pooled over years while the lowest length of spike with awn was recorded in mutant GHA3-1 in I, II year and pooled over years. The highest length of spike without awn was found in standard variety Jyoti in I year and pooled over years both and mutant K50-19 in II year but the shortest spike without awns was found in mutants GHA3-1 in I year, K50-84 both in II years and pooled over years.
Mutant K40-37 in I year, K40-39 both in II year and pooled over years contained the maximum number of grains/spike while mutants GHA3-1 in I year, variety Gitanjali both in I year and pooled over years had the minimum number of grains/spike. Mutant K40-72 in I year, KHA3-6 both in year II and pooled over years gave the maximum 100-seed weight while mutants K50-11 in I year, GHA3-1 both in II year and pooled over years produced the minimum 100-seed weight.

In years I, II and pooled over years the biological yield per plant was the maximum in mutant K40-72 while it was the minimum in mutants K40-62 in I year, K50-84 both in II year and pooled over years.

The seed yield per plant was the highest in mutant K40-72 in year I and pooled over years both and K30-7 in year II while the lowest seed yield per plant was in mutant K50-84 in year I, II and pooled over years. The highest straw yield/plant was recorded in mutant K40-72 in all three years and lowest in mutant K40-62 both in year I and pooled over years and K50-84 in II year. The maximum harvest index was estimated in mutant K30-76 in I year, K50-11 both in II year and pooled over years and the minimum harvest index was estimated in mutant K40-88 in I year and K30-8 both in II year and pooled over years.

The maximum soluble sugar content in grains was obtained in mutant K40-72 in I year, K30-76 in year II and K50-13 in pooled over years. The minimum soluble sugar content in grains was obtained in mutant K40-55 both in year I and II, K50-19 in pooled over years. The maximum insoluble sugar content in grains was recorded in mutant
K50-84 in year I and pooled over years both and in K50-27 in II year and the minimum insoluble sugar in grains was estimated in mutants K50-13, K40-39 and K50-72 in all three years.

The highest soluble protein content in grains was estimated in mutant KE2-18 in I and pooled over years both and in K50-27 in II year and the lowest in mutant K30-8 in I year, K50-26 both in II year and pooled over years. The maximum crude protein content in grains was obtained in mutant KE2-18 in I year, K50-19 in II year and K50-11 in pooled over years and the lowest in mutant K50-26 in year I, II and pooled over years.

**Genetic variability**

In both years and pooled over years the higher estimates of GCV were recorded for insoluble sugar in grains, straw yield per plant, soluble protein in grains, number of tillers per plant, biological yield per plant, soluble sugar in grains, number of grains per spike, seed yield per plant, leaf area and 100-seed weight. Whereas, the lower estimates of GCV were recorded for days to maturity, length of spike with awn, crude protein content in grains, harvest index, plant height and length of spike without awn.

The estimates of PCV were also high for insoluble sugar in grains, number of tillers per plant, straw yield per plant, soluble sugar and soluble protein content in grains, leaf area, biological yield per plant and seed yield per plant. Similarly the estimates of PCV were low for
day to maturity, length of spike with awn, crude protein content in grains, harvest index, plant height and length of spike without awn.

**Heritability and Genetic advance**

In both years and pooled over years, the higher estimates of heritability were recorded for insoluble sugar in grains, 100-seed weight, soluble protein content in grains, crude protein and soluble sugar in grains, days to maturity, number of grains per spike, plant height and leaf area. The low to medium estimates of heritability were recorded for number of tillers per plant, harvest index, straw yield per plant, biological yield per plant, length of spike without awn and seed yield per plant.

The estimates of genetic advance in both years and pooled over years was high for insoluble sugar content in grains, number of grains per spike, plant height, biological yield and straw yield/plant. Similarly the estimates of genetic advance was low for length of spike without awn, crude protein content in grains, 100-seed weight, length of ear with awns, soluble protein and soluble sugar content in grains.

**Character Association**

* Days to maturity had positive significant association with number of grains in first year and pooled over years while it was associated significantly negative with leaf area in first year.
* Number of tillers showed significant positive association with leaf area in first year, with length of spike without awn, biological yield, seed yield and straw yield per plant in second year. It showed significant
negative association with length of spike with awn, length of spike without awn, number of grains per spike and 100-seed weight in first year, leaf area in second year and 100-seed weight in pooled over years.

* Plant height exhibited significant positive association with length of spike (with and without awn) in first year and with biological yield and seed yield per plant in pooled over years.

* Leaf area showed significant negative association with 100-seed weight in I year, Length of spike without awn, biological yield and straw yield in pooled over years.

* Length of spike with awn expressed positive significant association with length of spike without awn and 100-seed weight in I year, length of spike without awn and number of grains per spike in second year and length of spike without awn, 100-seed weight, number of grains per spike and seed yield per plant in pooled over years.

* Length of spike without awn showed positive significant association with number of grains per spike, 100-seed weight, biological yield per plant, seed yield per plant in first year, number of grains per spike, biological yield and straw yield in second year and number of grains per spike, 100-seed weight, biological yield, seed yield and straw yield per plant in pooled over years. A significant negative association between length of spike without awn and harvest index was observed in second year.

* Number of grains per spike had significant positive association with biological yield and straw yield per plant in second year.
* The test weight showed significant positive association with seed yield in first year, with biological yield and straw yield in second year and with seed yield in pooled over years.

* Biological yield exhibited significant positive association with seed yield and straw yield in first year, second year and pooled over years. It also exhibited significant negative association with harvest index in second and pooled over years.

* Seed yield expressed significant positive association with straw yield, harvest index and soluble sugar in first year, with straw yield in second year and pooled over years.

* Straw yield exhibited significant negative association with harvest index and soluble protein in first year, with harvest index in second year and with harvest index, soluble protein and crude protein in pooled over years.

* Harvest index had significant positive association with soluble protein and crude protein in first year and pooled over years and with crude protein in second years. It also had significant negative association with insoluble sugar in second year.

* Soluble sugar did not show significant positive or negative association with rest of the characters.

* Insoluble sugar showed only significant negative association with crude protein in second year.

* Soluble protein had positive significant association with crude protein in first year, second year and pooled over years.
More insignificant correlation was found either positive or negative in the characters for soluble sugar and insoluble sugar in grains with all characters association in all the three years.

It is suggested that improvement in the characters like biological yield per plant, harvest index, number of tillers per plant, length of spike without awn, number of grains per spike, 100-seed weight, soluble protein and crude protein content in grains will help in improving the seed yield in the sense of direct selection.

Mutant K40-72 had the highest seed yield per plot followed by K40-37, K40-55, KE2-18, K50-26, K50-72, KHA3-6, K30-76, K50-13 and K50-65. Mutant GHA3-1 had the lowest seed yield per plot followed by K30-8, K30-29, K50-12, K50-60, K50-27, K40-40 and K50-11.

The selected high yielding mutants having improved nutrient contents may be used for breeding purpose and cultivation to obtain high yield and nutrients.

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