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# A Study of Nutritive and Productive Value of Barley Green and Forage

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***Abstract:*** *If the correct crop is chosen, forage crops can be a valuable tool for farmers, but careful management is needed to make sure the crop is completely utilised during its most fruitful and nourishing stages of growth. To reduce their negative effects on productivity, pests and diseases must also be controlled. The productive potential of a fodder crop can be maximised by using a carefully thought-out grazing strategy. Forage crops can either be grazed first and then set aside for the conservation of fodder, or they can be grown entirely for the production of hay or silage. This paper reviews the nutritive and productive value of Barley in different aspects.*
***Keywords-****forage crops, Nutritive value, Productive value etc.*

## I. Introduction: Why Forage Crops

The foundation of sustainable agriculture is forage crops. Forages, which are defined as the edible plant components other than separated grain that are used as animal feed or that can be gathered for use as animal feed, are crucial to the beef cattle sector and also improve crop diversity, wildlife habitat, and soil ecosystem services. To ensure that the quality and quantity of preserved fodder are optimum, scheduling is essential for both grazing events and the cutting for hay or silage. There are several types of forage crops:

Annual fodder crops: Because annual forage crops mature, develop, and gerinate from seed all in the same growing season, seed establishment is made easier.

Biennial forage plants: Biennial forage plants require two growing seasons, the first of which is used for vegetative growth and the second for flowering.

Forage plants that are perennial can survive for more than one year and can briefly go dormant before beginning to germinate from crowns, rhizomes, etc.

Forage crops with grass roots that can increase the soil's organic matter level. Forage crops are abundant in vitamins, fibre, and proteins that help animals' metabolisms. Mineral-rich forage crops are beneficial to chickens for the formation of bone, eggshells, fluid balance, and hormone synthesis. To complement warm-season perennial grasses, increase the seasonal distribution of fodder production year-round. Forage crops inhibit the growth of weeds. It slows down soil erosion.

### NUTRITIVE VALUE OF FORAGE CROPS

The chemical makeup of forages, intake, digestibility, and utilisation of absorbed food, as well as the nature of the digested products, all contribute to their nutritional value. The chemical composition, digestibility of plant components, and quantity of feeds consumed by ruminants are used to evaluate the quality of forages. However, the total amount of forage consumed by an animal has a significant impact on its response because it affects the total amount of nutrients ingested.

### BARLEY

Hordeum vulgare L., a significant cereal crop, is produced largely for its grain, but it also produces important forage that can be used for grazing, cut while still green for hay or silage, or cut after grain harvest for straw. The annual barley plant is an upright, tufted grass that can grow to a height of 50 to 120 cm. A leafy species is barley. Along the stem, the up to 25 cm long, linear and lanceolate leaves are positioned across from one another. Compared to other cereals, barley leaves are wider and have a higher leaf:stem ratio (0.88). There are hundreds of cultivars and thousands of landraces of farmed barley. The number of rows of grains (2-row and 6-row barley), compactness of the spikes, hull adherence (hulled or naked barley), presence or size of awns (awned, awnletted, or awnless variants), growth pattern (winter or spring barley), and colour are among the variables used to classify cultivars (black, purple or white kernels).

Barley fodder is not typically used for feeding reasons, but it is becoming more common. When there is a drought or when the grain production has been hampered by frost damage to the barley crop, barley can be a good fodder. Up until the late 1990s, better forage quality was infrequently considered when choosing forage barley varieties; instead, yield and other agronomic traits were the only factors considered. Whole plant silage is now a significant source of nutrition for both ruminants and other species. Winter and summer silage varieties

are occasionally combined with a quick-growing grass variety when being sowed. Whole plant silage can be employed in large-scale cow production since it is high in fibre and low in protein. Two-row variations and awnless varieties are reported to be more nutrient-dense as pasture and to be safer (see Potential limitations). Barley fodder can still be harvested for grain without reducing grain output if it is directly grazed or cut early enough. Forage made from barley can also be used to create cellulose pulp, hats, and bedding. One of the highest-quality cereal straws is made of barley; for further details, check the Straws datasheet.

## II. Literature Survey

Indirectly contributing to plant growth, but acting as inhibitors of insect and fungal attack, plants create compounds. In some plants, the availability of feed anti-nutritional elements limits the usefulness of leaves, pods, and edible twigs of shrubs and trees as animal feeds (ANFs). Feed anti-nutritional factors are defined as substances produced in natural feedstuffs by the normal metabolism of species and by various mechanisms (for instance, the inactivation of some nutrients, a decrease in the digestive process, or a metabolic utilisation of feed) that have an effect counter to optimum nutrition. ANFs have different effects according on the type of plant, animal, and stage of growth. Pigs, poultry, and horses are examples of non-ruminants that are typically more sensitive to toxicity than ruminants. Tannins, oxalates, saponins, and cyanide-containing fodder crops are a few examples of anti-nutritive elements in feed.

Poor feeding and nutrition, particularly during the dry season, are a barrier to increased cattle productivity (growth rate, milk output, meat production, draught power, reproductive efficiency, conception rate, and calving interval). Protein, or crude protein (CP), is the most limiting ingredient in addition to energy, and feed shortages in the tropical region, including India, limits livestock production in terms of both quantity (biomass) and quality. Tanzania's production of livestock, which is primarily based on the traditional production method with a small proportion being under the commercial agricultural system, is a significant economic activity, particularly in rural areas. For feeding their livestock, particularly during dry seasons, agro pastoralists in many arid and semi-arid regions of the world rely mostly on standing hay and crop wastes like stovers, straw, and chuffs. The intrinsic low nutritional content of these feeds, which has been linked to low animal productivity in terms of growth, meat, milk, work, and poor reproductive efficiency, restricts their use (silent heat, low conception rates, high number of mating per conception, long calving intervals)

**Distribution**

A common cereal that can grow in a variety of climates is barley. In North America, Europe, and the Mediterranean region, barley is mostly utilised as forage. Compared to other small grain cereals, barley forage does better in cooler, drier climates. Barley should not be grown on poor, sandy, or wet soils since it is best suited to rich, loamy soils with good drainage. It favours soil pH levels over 6. Barley thrives in saline and alkaline soils and can endure brief droughts. It isn't as resistant to the winter as wheat or rye. Barley should not be sown in more temperate climates or too early in the autumn since it is susceptible to rust and disease. It shouldn't be sown in hot, humid temperatures in tropical regions.

**Management of forages**

As a solitary crop or in combination with a legume like vetch, pea, berseem (Trifolium alexandrinum), or Persian clover, barley forage can be planted (Trifolium resupinatum). In particular, intercropped barley-legumes have a higher total yield than either barley or legumes grown as a solo crop. Intercropping is also excellent at minimising diseases, controlling weeds, and capturing a larger portion of the resources that are accessible. By boosting the DM and protein content of the forage in comparison to the cereal crop alone, intercropping barley with a legume enhances the nutritional value.

**There are various management options for barley forage planted as the only crop:**

Winter barley should be sown early in the autumn (early to mid-September) under low moisture conditions in order to establish itself before winter and to produce higher yields. Early-seeded barley can produce high-quality grazing.

Winter barley should, however, be planted as late as possible (mid-autumn) when there is a lot of moisture present so that rust cannot ruin the harvest.

A excellent rotation crop in a grain production system to supply livestock feed and control weed populations is early-planted and well-managed spring barley forage.

Depending on the stage of growth at cutting and the environmental factors, barley forage seeded alone may yield 3 to 8 t DM/ha. With spring barley, the earlier the seed is sowed, the greater the forage yield. Potential crops should be cut or grazed at a height of 30 to 40 cm for the highest quality feed and good regrowth. To guarantee high-quality regrowth, crop fertiliser should be added after each cut. Cutting should take place

long before the emergence of awns, which will lessen the forage's palatability. In hay, young awns are acceptable. 2-3 cuttings or grazings from an autumn plant are feasible. Wheat pasture

Prior to grain production, using barley for forage may be an effective approach to manage barley; it may help prevent crop lodging and reduce foliage fungal infections while feeding cattle. Barley grain output and grain quality are not harmed by grazing if it happens early enough in the growing season. Typically, the crop can be cut or grazed for six weeks before the first node appears. Grain yield is hampered after this point. Late heavy grazing proved to increase forage yield more than continuous grazing did, but it had a negative impact on grain production. Unlike wheat or rye, winter barley shouldn't be grazed as closely or as late in the fall.

**Wheat hay**

Increase the grazing season in northern regions by swath grazing barley forage or barley/legume. Hay can be made from cut and dried barley. In many areas, it provides an important source of winter fodder. A readily available, reasonably priced feed source is barley hay. To create hay, it should be cut when it is still milky. Due to the fact that it disrupts weed and disease cycles, barley haymaking is appropriate in irrigated systems, including alfalfa production. When barley fodder is harvested for hay at the milky stage, the NO3-N levels are kept to a safe level for livestock—0.14%.

Silage Barley is easy to ensile due to its high carbohydrate content, and when the pH quickly decreases, it produces a high-quality silage. A barley crop is considered silage-worthy when it has reached the soft-dough stage of growth. The most important element in the creation of silage is the moisture content of the barley feed, which must be between 64 and 72%. If allowed to get any drier than this, the forage might be difficult to pack tightly enough to establish an anaerobic atmosphere. If this is not done, nutrient losses and excessive heating could happen. It is advisable to short-chop the forage and shut the silo as firmly as possible to reduce air content. A well-made barley silage should have a pH between 4.2 and 4.8, be light green-yellow to green-brown in colour, smell lactic acidic without any off-flavor from butyric acid, and be between those three characteristics.

**Straw**

Barley straw is a less expensive option for feeding cattle, while having less feed value than oat straw. If properly supplemented, it can be provided as the only roughage during the winter.

**Salinization of soil**

The grain crop that tolerates salt the best is barley, which continues to thrive even at high salinity levels. Due of its ability to dilute and exclude salt, barley is frequently utilised in soil restoration. Six-row, smooth-awned barleys may withstand saline better than other varieties of barley.

**Erosion prevention and soil enhancement**

Barley aids in reducing soil erosion thanks to its robust root system, which may reach depths of 1.8 to 2.1 metres. Additionally, it can be used as green manure in the spring to increase the soil's organic matter level while also providing nourishment and cover during the winter.

**Shelter**

Because it reduces the likelihood of frost, barley is frequently utilised in California vineyards as a shelter crop for young grape shoots.

Between flowering and dough stage, the protein and NDF content of barley fodder decreases from 12 to 9% DM for protein and from 63 to 56% DM for NDF, respectively. The rise in starch (up to 20% at the mid-dough stage) is primarily responsible for the decline in protein and NDF. Some whole crop silages have been shown to contain higher starch and lower NDF concentrations (29 and 47%, respectively, in Ireland; Walsh et al., 2008). Increased starch can be obtained at heading at the expense of NDF (32 and 44%, respectively). Compared to other small grain forages, barley forage often has lower amounts of cell walls, ADF, and lignin.

**Straw**

Untreated straws contain between 2 and 6% of protein and between 80 and 86% of NDF, respectively. Hay values fall somewhere in the middle of straw and fresh forage values. Some types of barley that are used to make hay or silage have rough or barbed awns that could hurt livestock's mouths.

An increase in nitrates

Nitrate accumulation in forage barley can cause nitrate poisoning in animals, which can be fatal. All types and classifications of animals are deemed hazardous by NO3-N values greater than 0.226%. At the boot stage, 0.23% NO3-N was discovered in the barley feed. It is feasible to choose new types of barley with low NO3-N potential.

**Ruminant Absorption**

According to maturation stage, the OM digestibility of barley fodder varies just significantly, rising from 61 to 65% between blooming and the dough stage. This relates to both a decline in NDF digestibility and an improvement in digestibility due to an increase in grain and starch content. Comparable figures have been observed for silage, ranging from 64-67% at 35-40% DM to 59% in the milk-dough stage (about 35% DM). Untreated straw has a 44–45% average OM digestibility It can be significantly enhanced by ammonia treatment: urea (30–40 g urea/kg DM): + 6–8 points, urea (30–40 g urea/kg DM): + 11 points, or NaOH (40 g/kg DM): + 14 points.

**Silage Milking cows**

It is possible to harvest barley forage used to make silage at the heading, milk, or dough stages (i.e., between 27 and 49% DM, 40 to 60% grain).

There is no benefit to adding acid when the crop is harvested in the late milk/early dough stage (35–40% DM). The best time to harvest is not crucial because the quality of the forage declines gradually with maturity. This is because as maturity increases, DM intake and apparent digestibility tend to decline, which affects milk yield, milk protein, and milk fat. Delaying the planting date (June vs. May) at a similar stage (late-dough) for silage production causes a higher in vitro NDF digestibility and protein content, but this had no effect on intake and milk production in cows at mid to late lactation. However, it did tend to improve LW gain. Cows that are dry or lactating late and eat less than 1.9% LW can get along on whole crop barley silage provided ad libitum as their only source of nutrition. Dairy cows supplemented with concentrate at 1% LW in the beginning or middle of lactation can significantly enhance their intake of barley silage to 2.5 percent of LW (Lund et al., 2006). When dairy cows are fed 50% forage diets throughout the early lactation period, barley silage is comparable to pea or alfalfa silages in terms of intake and milk production.

**Bovine meat**

Beef cattle are fed and digest barley silage in a manner similar to that of maize or wheat silage. When supplemented with grain, cattle calves or rams can consume whole crop barley silage. With barley-based diets or barley + DDGS diets (wheat dried distillers grains with solubles), beef cattle need 15-20% silage to prevent digestive problems. The average daily growth and feed efficiency in feedlot cattle fed high, 80% barley silage diets may be marginally improved by spraying a commercial xylanase and cellulose on barley silage.

**Hay**

Vetch-oat hay has a lower ingestibility than barley hay (2.5% LW, or 65 g/kg LW0.75 in dry, non-lactating adult ewes). Ewes can consume barley hay supplemented with less than 50% concentrate from three weeks prior to lambing until 120 days following lambing. Barley can be used to make straw. Poor ingestibility of untreated barley straw (1,3% LW in castrated sheep) necessitates gradual adaptation, which can be sped up by nitrogen supplementation. A different forage, cereal, or supplements should be offered to it. Intake, straw breakdown and digestibility, weight gain, and feed efficiency were all demonstrated to increase when untreated straw was supplemented with whey, urea and citrus by-products, or molasses in goats and sheep.

Urea (4–5% DM), ammonia (2–3% DM), and NaOH (4%) can be used to treat barley to increase intake, OM digestibility, and performance. But urea addition at 1% DM was ineffective (Haddad, 2000). Treatment with urea was shown to be more effective than ammonia. For growing sheep, urea-treated straw was sufficient for maintenance and permitted a small amount of live-weight growth. Sheep were raised on straw that had been ammonia-treated at 1.9% LW without supplementation. When supplemented with concentrate (a barley/citrus pulp combination), it was also effectively absorbed by lactating ewes (at 2.5% LW). Dairy cows fed diets containing both grass silage and winter barley straw benefited from the treatment with NaOH because it considerably increased the digestibility of the forage and boosted forage intake and milk yield. Contrary to untreated straw, the intake and digestibility of treated barley straw in sheep and goats were not even modestly increased by supplementing urea-treated straw with alfalfa hay or vetch hay, dried lemon, or citrus by-products.

**Pigs**

Pigs can be given fodder if it is gradually introduced to them. If forages are properly supplemented, they tend to offer more crude protein than cereal grains and could therefore result in lower feed expenditures. Fresh, dried, or ensiled forages can be provided. Pigs can graze on barley, which is tasty and nourishing to them. However, it cannot be severely grazed and does not produce as much dry matter as, say, rye fodder during the fall and winter. In comparison to winter wheat fodder, it provides fewer nutrients (and less protein) to pigs.

**Foraging Rabbits' Green**

Wild rabbits appear to graze on barley fields in the winter or spring, showing that green barley plants are tasty to rabbits. When trying to feed rabbits hydroponically grown barley fodder, in which the grain was germinated and allowed to develop for about 2 weeks (10–12 cm in height) before being fed, this common observation was made. Growing rabbits and breeding does with their young readily absorb this fodder, and it is completely digested. Due to insufficient amounts of digestible energy and protein, barley forage dry matter generated by hydroponics has a lower nutritional value than a complete pelleted diet. However, when provided ad libitum together with a little amount of a pelleted complete diet, this type of barley forage may make up to 40% of the daily DM intake without appreciably impairing growth or reproductive performance. Giving suckling bunnies fodder grown hydroponically seems to encourage early dry matter ingestion. However, it should be mentioned that French rabbit farmers' successful usage of hydroponically grown barley in the 1980s and 1990s was discontinued as a result of the development of uncontrollable moulds that create mycotoxins in the germination apparatus.

**Dried-up whole plant**

A source of fibre for growing rabbits could be dehydrated whole plant barley that is cut at the waxy stage and contains about 50% NDF with a moderate quantity of lignin (6.3-7.6% DM). This forage produced growth performance that was comparable to the control diet when it was included at up to 28–35% of a balanced diet. Although the protein content was relatively low (6 to 8% DM) and the nitrogen digestibility coefficient was moderate (62 to 66%), the digestible energy content was considerable for a pasture at roughly 8.4 to 10.7 MJ/kg DM.

## III. Conclusion

Based on the study's findings, it can be said that barley seeds produced more feed under a semi-intensive hydroponic system, with superior gains in nutrients such fresh feed weight, crude protein, and ether extract content. As a result, barley seed is thought to be the superior option since it can be utilised to produce hydroponic green fodder with less water use, less effort, and more nutritional content

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