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Mini Review Article

Grasses (Poaceae) of Haryana, India, with special reference to Jhajjar District: Current research status and future perspectives

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ABSTRACT
Numerous wild grasses provide essential ecosystem services, fodder, and thatching material, and have cultural value for rural inhabitants. Perennial grasses are also widely used for non-food purposes like landscaping, sports fields, lawns, and land reclamation, which highlights their species diversity and adaptability to changing climatic circumstances. Grasses are important for medicine because they contain bioactive compounds with antioxidant qualities, such as flavonoids and phenolics. These traits link the Poaceae family to traditional and therapeutic uses worldwide. As interest in plant-based, safe, and affordable drugs grows, many compounds produced from plants are being studied for the treatment of different ailments. Even though many grass species are still insufficiently recognized, they have significance for dietary needs, ecosystem stability, and industrial applications. Research on their variety, ecological roles, and sustainable applications is important. Socioeconomic and environmental benefits can be fostered by protecting grasslands and recognizing their future applications. Enhancing scientific understanding of Jhajjar grass biodiversity through a variety of studies, genetic analyses, soil correlation studies, and ethnobotanical documentation will help with conservation planning, sustainable management, and the optimal use of grasses for agriculture and ecological restoration.

1. Introduction

The family Poaceae (Gramineae), usually known as the grass family, is one of the largest and most commercially significant plant groups in the world, with over 12,000 species [1]. Another abundant source of nutrients is grasses. All concentrated habitats that are favourable to the development of plant communities contain members of this category. Additionally, perennial grasses are frequently employed in non-food uses such as landscaping, sports fields, lawns, and land reclamation, demonstrating their species richness and functional resilience under changing climatic conditions [2]. These roles include industrial, artistic, and land-protective roles that go beyond the conventional food or fodder viewpoint. The significance of species selection for particular ecological or utilitarian roles is highlighted by their ability to adapt to environmental changes [3]. One study demonstrates how local populations select, assess, and select species for fodder, especially in semi-arid areas, by highlighting the indigenous knowledge around grasses used in animal feed and traditional veterinary practices [4]. Because they include bioactive substances like flavonoids and phenolics that have antioxidant properties, grasses have therapeutic significance. These characteristics connect the Poaceae family to customary and medicinal applications across the globe. Many plant-derived chemicals are being investigated for the treatment of various diseases as interest in plant-based, safe, and reasonably priced medications develops. *Eleusine coracana*, sometimes known as finger millet, is an annual grass with substantial medicinal potential that is rich in secondary metabolites [5]. About 85% of traditional medicine is derived from herbs and used to treat survival-related illnesses. Uses of herbal medicine based on traditional information. Because of their useful characteristics, evolutionary background, and interactions with fire and herbivores, grasses have been successful all over the world, offering important ecological insights for the use and management of these species [6].

Communities in Himachal Pradesh, especially in the Western Himalayan district of Kinnaur, still use traditional medical practices. Between May 2011 and September 2014, field investigations identified 20 wild Poaceae species with traditional and therapeutic applications, providing important ethnobotanical information from this high-altitude area that is mostly covered by snow [7.] Climate, soil, and altitude all influence the richness of grass species in India, with mid-elevations exhibiting greater diversity. Local climate conditions are reflected in functional features (C_3/C_4 and life forms). The necessity for ecologically informed conservation is highlighted by the fact that many species have limited ranges, making them susceptible to disturbance and climate change [8].

Although many species of grasses are still insufficiently recognized, they are essential for industrial applications, ecosystem stability, and fodder. It is essential to conduct research on their ecological roles, variety, and sustainable uses. Preserving grasslands and investigating their possibilities can promote socioeconomic and environmental advantages [9].

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2. Review of Literature

A study conducted in five districts of Haryana during the rabi season in 2017–18 revealed that Phalaris minor had widespread herbicide resistance, which posed a significant threat to the output of cereal crops. This emphasizes how important it is for understanding Poaceae weed dynamics in order to maintain high-quality agricultural systems in the state [10].

In a different 2018 survey conducted in the Rohtak district, 28 weed species were found in wheat fields. The Poaceae family, which includes *Poa annua*, *Polypogon monspeliensis*, and Cynodon dactylon, was the most prevalent. These results demonstrate the ecological significance of grasses in the agricultural landscapes and weed flora of Haryana [11].

In practically every region of India, grasses are present. Various workers have reported the ethanobotanical value of grasses from different parts of India [12-15].

The diversity and ecological significance of Poaceae members in semi-arid Haryana were documented by Yadava and Singh (2016) in their floristic survey of Kurukshetra district, which was published in *Annals of Arid Zone*. Numerous grass species were found in grazing areas, marshes, fallow lands, and agricultural fields, demonstrating their adaptation to regional edaphic and climatic circumstances. The authors highlighted the significance of Poaceae plants as the region's main sources of fodder, soil stabilizers, and essential elements of agro-ecosystems. Their work supports rangeland management, fodder planning, and biodiversity conservation programs in Haryana by providing important baseline data on grass diversity [16].

A floristic inventory from the Karnal district identified 345 angiosperm species, with the Poaceae family being one of the most well-known. While not limited to grasses [17].

About 980 plant species were found during extensive botanical surveys in the Morni Hills (Panchkula), a region of the Shivalik foothills, including 53 new records for Haryana. The surveys probably included a number of Poaceae members despite covering all vascular plants, which improved knowledge of the biodiversity of grasses in the foothill habitats of the Himalayas [18].

950 vascular species were identified by additional research in the same area that evaluated at the life-form and biological spectrum. These studies provided information on vegetation structure, ecological characterization, and patterns of grass distribution [19]. A 2024 research in Shivalik Hills Kalesar National Park identified 17 new varieties of grass from the region [20].

The production of pearl millet (*Pennisetum glaucum*) in Haryana was the subject of a 2023 study that examined patterns of energy consumption in agricultural techniques. This study highlights the Poaceae crops' agronomic and economic significance in the state's semi-arid farming systems [21]. It has been demonstrated that Karnal grass (*Leptochloa fusca*) is an efficient primary colonizer of alkali soils that have been abandoned in terms of land restoration. Without reducing fertility, it enhances soil qualities and yields large amounts of fodder. Growing alongside *Prosopis juliflora* considerably lowers the pH and salinity of the soil, increases organic carbon, accessible nitrogen, and water-holding capacity, and improves the general productivity of degraded areas. These results demonstrate that biological reclamation with grasses in agroforestry systems is an affordable and sustainable method of repairing marginal soils [22-25]. An ethanobotanical survey of Haryana floral diversity was carried out by others [26-28], have all recorded the traditional knowledge of medicinal plants used in India to treat a variety of illnesses.

Because they provide food, fodder, medicinal resources, and cultural value, grasses (family Poaceae) have long been essential to human livelihoods. Many medicinal grasses are still little understood, despite the fact that grasses like *Cynodon dactylon*, *Saccharum spontaneum*, and *Eulaliopsis binata* are frequently used in traditional medicine and contain bioactive compounds with significant therapeutic potential [29].

The therapeutic potential of grasses in the Haryana region has been attributed to the presence of bioactive phytochemicals such as phenolics, flavonoids, alkaloids, and saponins, especially in members of the Poaceae family including *Digitaria* and *Cynodon*. Because of these chemicals' antioxidant, antibacterial, anti-inflammatory, and antidiabetic properties, grasses are useful for both traditional medicinal uses and feed. Despite the paucity of Haryana-specific research, studies on regional *Digitaria* species and more general evaluations of Poaceae plants in India attest to their medicinal significance [30, 31].

In North India's dairy-intensive fodder systems, especially in Haryana, where organizations like ICAR-National Dairy Research Institute are crucial to fodder research and development, ryegrass (*Lolium* spp.), especially *Lolium multiflorum* (annual ryegrass), is acknowledged as a highly nutritious and high-yielding cool-season forage grass with significant potential. In comparison to many conventional winter forages, ryegrass has been shown in studies to have greater nutritional value, including higher crude protein content and digestibility, quick growth, multiple cut capability, and good palatability.

Ryegrass generates significant yields of dry matter and green fodder under ideal agronomic management, especially with balanced nitrogen and phosphorus fertilization. This shows that the crop is responsive to nutrient inputs and suitable for intensive production systems. Further research in Haryana has demonstrated that, because of complimentary growth patterns and nutrient dynamics, integrating ryegrass with legumes like berseem in mixed cropping systems improves quality indices and increases overall fodder yield.

Experiments conducted at NDRI, Karnal, using a diversified fodder-based cropping system show that adding high-yielding winter forages, such as ryegrass, can enhance the profitability of dairy businesses, stabilize the year-round feed supply, and overcome seasonal shortfalls in green fodder. All of these results point to ryegrass as a crucial forage component in the Indo-Gangetic Plains, supporting sustainable dairy intensification in areas like Haryana, increased animal output, and better feed resource efficiency [32-35].

When compared to full chemical fertilizer alone, integrated nutrient management—which combines partial chemical fertilizer with PGPR and panchagavya—improved fodder oat growth, tillering, and green fodder yield. This suggests a sustainable strategy for increased productivity in dairy-based systems. This type of study demonstrates useful agronomic strategies for raising grass and feed production under Haryana circumstances [36].

3. Discussion

Jhajjar is located in the semi-arid region of Haryana, where soils range in texture from loam to sandy-loam and are primarily alluvial in origin. In comparison to the more productive areas surrounding the Yamuna flooded area, the soils in this zone frequently have less organic content and a lesser capacity to hold water. Both natural deterioration and human activity, especially industrialization, are having an increasing impact on the quality of the soil in Jhajjar District. According to studies, crop yields and agricultural sustainability have been impacted by decreased soil fertility due to salt, waterlogging, and decreased organic matter.

Metals like lead (Pb), copper (Cu), zinc (Zn), cadmium (Cd), and nickel (Ni) have been found in soil samples. Heavy metal deposition from traffic and adjacent industry is another way that industrialization adds stress. Rapid changes in land use, such as the growth of industrial and built-up regions, limit agricultural land, and modify natural soil processes. Insufficient care of municipal and industrial waste may deteriorate the chemistry of the soil, impacting ecological balance and fertility. In order to maintain soil health and agricultural output in Jhajjar, these findings point to the urgent necessity for sustainable soil management and monitoring of industrial impacts [37-41].

Although there is currently little focused research on Jhajjar, grasses and fodder grasses are important for soil stability and fodder supply; general agronomy shows their advantages for soil health and erosion management [42]. Poaceace is the dominant family, according to a floristic survey conducted in Haryana [43].

Similar to this, a floristic inventory conducted in Haryana Himalayan foothills (Morni Hills) revealed that the Poaceae family had the most species among the plant families identified, indicating that grasses make up a sizable portion of the state's flora, particularly in herb and understory layers [44].

Poaceae is one of the most prevalent plant families found in Jhajjar District, Haryana, with 35 genera and 57 species identified in the district's flora [45].

Larger lists of medicinal plants were found in surveys conducted in Bahadurgarh (Jhajjar subdivision), but once again, grasses were not the primary focus; just a few grasses, such as *Cyanodon dactylon* and *Sacharum officinarum*, have been studied [45, 46].

4. Conclusions

There is a wide diversity of grasses (Poaceae) in Haryana and the Jhajjar district, but the majority of current study is restricted to floristic inventories and basic soil assessments, with little ecological, ethnobotanical, phytochemical, genetic, and conservation expertise. Quantitative research on species abundance, habitat specificity, and soil-grass interactions is lacking, and traditional uses, forage potential, and phenological patterns of local grasses are not well documented. Furthermore, no genetic or molecular research has been done to comprehend population diversity or conservation evaluations for native grass species, particularly in the Jhajjar region. In addition to improving scientific knowledge of Jhajjar grass biodiversity, addressing these issues through various studies, soil correlation studies, genetic analyses, and ethnobotanical documentation will support conservation planning, sustainable management, and the best use of grasses for agriculture and ecological restoration.

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Authors' contributions

The author read and approved the final manuscript.

Conflicts of interest

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