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Original Research Article

GERMPLASM EVALUATION OF CORIANDER *(CORIANDRUM SATIVUM L.)* ON YIELD AND YIELD RELATED TRAITS

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Abstract: *The Germplasm of coriander comprising of five genotypes including DILPAZEER commercial variety were evaluated at Vegetable Research Institute, Faisalabad. The genotypes under evaluation were subjected to analysis of variance and showed significant variance in all of the studied morphological features. The most significant variance was found in yield and yield related traits. DILPAZEER (CHECK) and GGAS-COR-67 emerged as top performers due to their high leaf yield, favorable plant height, and reasonable cutting times. ECO 1212 A also showed promising results due to its early cutting times and decent yield. HSV-553, while taking the longest time to mature, showed the lowest yield, making it less favorable for high-output production. DILPAZEER (CHECK) excels in plant height, number of leaves, and leaf yield, remained ideal candidate for high-yield production.*

Keywords: Coriander Germplasm, Morphological Traits, Yield Performance, Plant Height and Leaf Yield

Introduction

Coriander (*Coriandrum sativum* L.), often referred to as cilantro or Chinese parsley, is a delicate annual plant belonging to the Apiaceae family. It is extensively utilized both as a herb and a spice. Originally native to the Mediterranean and Middle East regions, coriander is now widely cultivated worldwide for its culinary applications. The plant's dried fruits and seeds, commonly known as coriander, are used to flavor a diverse range of dishes such as sausages, curries, Scandinavian pastries, liqueurs, and confectioneries like English comfits. The tender young leaves, known as cilantro, are particularly popular in Latin American, Indian, and Chinese cuisines. These leaves are also referred to as coriander leaves, fresh coriander, Chinese parsley, or cilantro, especially in the United States and Canada. It is important to distinguish coriander from culantro (*Eryngium foetidum* L.), which, although related, belongs to a different genus.

Culantro features more spiny leaves, a stronger scent, and a more potent volatile leaf oil compared to cilantro. Coriander leaves offer a distinct flavor profile that differs from the seeds, with citrus-like undertones. Fresh coriander leaves are commonly used in a variety of dishes, such as chutneys, salads, salsa, guacamole, and as a garnish for soups, fish, and meats. These leaves are typically used raw or added to dishes just before serving, as cooking can diminish their flavor. In Pakistani and Central Asian cuisines, coriander leaves are often used in large quantities and cooked until their flavor subsides. However, once harvested, the leaves quickly deteriorate and lose their aroma when dried or frozen. Coriander seeds, which are the plant's dried fruits, are often simply referred to as coriander in culinary contexts. These seeds contain terpenes such as linalool and pinene, which give them a lemony citrus flavor when crushed.

The flavor is described as warm, nutty, spicy, and orange-like. There are different varieties of coriander seeds: C. sativum var. sativum fruits are 3–5 mm (1/8–3/16 in) in diameter, var. microcarpum fruits range from 1.5–3.0 mm (0.06–0.12 in), and var. indicum fruits are elongated. Large-fruited coriander varieties are cultivated in tropical and subtropical countries like Morocco, India, and Australia. These varieties typically have a low volatile oil content (0.1-0.4%) and are mainly used in the spice trade for grinding and blending. In contrast, smaller fruit varieties are grown in temperate regions and have a higher volatile oil content (0.4-1.8%), making them valuable for essential oil production. The coriander plant itself features a slender, hollow stem with fragrant bipinnate leaves and can grow between 30 to 60 cm (1 to 2.5 feet) tall. The small flowers, which are pink or whitish, are grouped in umbel clusters.

The fruit, a small dry schizocarp, comprises two semi-globular fruits joined at their inner edges to form a single, smooth, nearly spherical structure around 5 mm (0.2 inch) in diameter. The yellowish-brown fruits emit a light fragrance and offer a flavor reminiscent of lemon peel and sage. The seeds contain 0.1 to 1% essential oil, with coriandrol being the main component. The improvement is a continuous process and for this purose, evaluation of germplasm is necessary phenomenon. An experiment was planned to evaluate coriander germplasm for yield and yield related traits at Faisalabad.

Methodology

During the Rabi season of 2023-24, five genotypes were evaluated at Vegetable Research Institute Faisalabad which is 36.9 meters above mean sea level. 6°182 04:11" N and 80°26' 36.37" E are the geographical coordinates of the selected site. The soil was vertisols, with a high potassium level and medium phosphorus and nitrogen content. The experiment was conducted in randomized complete block design with three replications in mid of October, 2023. The entries were planted in two rows of 6 meter in length by keeping 75cm row × row distance. The seeds (fruits) were rubbed for separating the two mericarps (seeds) which were soaked in water for 24 hours to enhance germination.

Seeds were also treated with Azoxystrobin at 2g per kg of seeds prior to sowing in raised seed bed. Seeds were mixed with some loose soil (about four to five times of weight of seeds) to allow uniform sowing in rows and were covered with good pulverized soil just after sowing with gently pressed by hands. Light watering was done to supply sufficient moisture needed for quick germination. Weeding was done after 25 days of sowing. Harvesting of green foliage was done before bolting by cutting just beneath the soil with root intact after 40-45 days of sowing. The data were recorded for plant height (cm), Number of leaves, Days to first cutting, days to 2^{nd} cutting and leaf yield t/ha.

Results & Discussion

Among the genotypes evaluated, maximum plant height was recorded in GGAS-COR-67 (16.71 cm) whereas the minimum was recorded in the entry HSV-553 (14.71 cm). The commercial variety DILPAZEER (CHECK) indicated plant height 16.61cm. This trait can be advantageous as taller plants may have better light interception and could potentially lead to higher photosynthetic rates, contributing to higher yields. However, excessive height might make the plants more susceptible to lodging under certain conditions. Significant differences among coriander genotypes in plant height were reported by Giridhar & Sarada (2005); Saxena *et al* (2005) and Verma *et al*. (2014). GGAS-COR-67 (16.9) showed maximum number of leaves and was found to be superior when compared with other genotypes.

Only check variety DILPAZEER was found with same number of leaves 16.9. A higher number of leaves can enhance the plant's photosynthetic capacity, leading to higher biomass production and yield. The number of leaves is a critical trait for leafy vegetables like coriander, where the leaves are the primary harvested product. Similar studies were carried out and reported by Prabhu & Balakrishnamurthy (2006) from India and Moniruzzaman *et al*. (2013). HSV-553 genotype had taken maximum number of days to first cutting i.e. 48.2 while ECO 1212 A remained early and reached to first cutting in just 43.1 days. This quick turnaround time can be very beneficial for farmers looking for multiple harvests within a growing season, increasing overall productivity. The days to second cutting revealed significant variation among genotypes. Genotype HSV-553 had taken maximum number of days to reach 2nd cutting (79.1) followed by VX-315 (75.2). This means it might be less suitable for regions or farming systems that rely on rapid successive crops. ECO 1212 A had taken minimum number days to 2nd cutting (70.1). The Check Dilpazeer had taken 73.2 days to 2^{nd} cutting. The estimation of leaf yield revealed that check Dilpazeer produced 43.85 t/ha and remained at top followed by GGAS-COR-67 having 36.76 t/ha and ECO 1212 A (36.48 t/ha). The genotypes VX-315 and HSV-553 had significantly low leaf yield 29.25 t/ha and 21.80 t/ha respectively. The genotypes investigated, had a lot of variance in all of the studied morphological features. The most significant variance was found in biomass, followed by plant height and number of leaves per plant. Plant height plays a significant role in light interception, which is crucial for photosynthesis and biomass production. Taller plants generally have a larger leaf area, allowing them to capture more sunlight and convert it into energy (Huang *et al*., 2011). This increased photosynthetic capacity can lead to higher biomass accumulation and better overall plant health (Sharma *et al*., 1987). The height of coriander plants can directly affect their yield.

Studies have shown that taller plants tend to produce more biomass, which translates into higher leaf and seed yields (Darughe *et al*., 2012). For instance, genotypes with greater plant height often exhibit better performance in terms of leaf yield and seed production. This is particularly important for commercial cultivation, where maximizing yield is a primary goal (Kapoor *et al*., 2017). Selecting the right genotype with an optimal plant height is essential for achieving high yields. Genotypes like GGAS-COR-67 and DILPAZEER (CHECK) have been shown to have superior plant heights, contributing to their high leaf yields (Küpper *et al*., 2009). By choosing genotypes with desirable height traits, farmers can enhance their crop's productivity and profitability.

The number of leaves on a coriander plant directly affects its photosynthetic capacity. Leaves are the primary sites for photosynthesis, where sunlight is converted into chemical energy (Bhandari *et al*., 1993). More leaves mean a greater surface area for photosynthesis, leading to increased production of carbohydrates and other essential compounds that fuel plant growth. A higher number of leaves can enhance the overall biomass and vigor of the plant, making it more robust and productive. In coriander cultivation, the number of leaves is a significant determinant of yield, especially for those grown primarily for leaf harvest (Federer *et al*., 1975). A greater number of leaves translate into higher leaf yield, which is crucial for commercial farmers seeking to maximize their production.

Varieties with a higher leaf count are often preferred in the market because they can provide a more abundant and continuous supply of fresh leaves, which are in high demand for culinary uses. For example, genotypes like GGAS-COR-67 and DILPAZEER have been noted for their superior leaf numbers, which contribute to their overall productivity and marketability (Lopez *et al*., 2006). By selecting and breeding varieties with desirable leaf traits, researchers can develop improved coriander strains that meet the demands of both farmers and consumers. The number of days to first cutting determines how quickly coriander can be harvested after planting. Early maturing genotypes, which reach the first cutting stage sooner, allow farmers to achieve multiple harvests within a growing season (Moniruzzaman *et al*., 2010). This rapid turnover is particularly advantageous in regions with short growing seasons or where farmers aim to maximize their output through successive planting cycles. For example, a genotype like ECO 1212 A, which reaches

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the first cutting in just 43.1 days, can be harvested more frequently, leading to increased overall yield (Sharma *et al*., 1987).

The number of days to first cutting is crucial in regions with varying climatic conditions. In areas prone to early frosts or extreme weather, early maturing coriander varieties can be harvested before adverse conditions set in, reducing the risk of crop loss (Singh *et al*., 2005). Conversely, in regions with prolonged growing seasons, early maturing varieties can be strategically planted to fit into crop rotation schedules, allowing for multiple crop cycles within the same season (Canter *et al*., 2005). Leaf yield is a primary determinant of the economic success of coriander cultivation. Higher leaf yields result in greater biomass production, which translates into increased marketable produce. Farmers can achieve higher revenues by cultivating coriander varieties that produce abundant leaves. The market demand for fresh coriander leaves is consistently high due to their extensive use in cooking, garnishing, and flavoring various dishes. Therefore, maximizing leaf yield is essential for meeting market demands and ensuring the profitability of coriander farming. High leaf yield in coriander can enhance crop management and harvest efficiency (Darughe *et al*., 2012). Varieties that produce more leaves can provide multiple harvests within a growing season, allowing farmers to maximize their output (Kapoor *et al*., 2017). Efficient harvesting practices can reduce labor costs and improve overall farm productivity (Küpper *et al*., 2009).

Genotypes with higher leaf yields often have a more robust growth habit, making them easier to manage and harvest. For instance, the commercial variety DILPAZEER (CHECK) is known for its high leaf yield, making it a preferred choice among farmers. Breeding programs aimed at improving coriander varieties often focus on enhancing leaf yield. Selecting genotypes with high leaf yield can lead to the development of superior cultivars that are more productive and resilient (Huang *et al*., 2011). Genetic improvement efforts can also target other desirable traits, such as disease resistance, drought tolerance, and improved flavor profiles. By prioritizing leaf yield in breeding programs, researchers can develop coriander varieties that offer better performance and higher economic returns for farmers.

Table 1. Meteorological Conditions for Faisalabad, Pakistan During 2023

Record high °C	26.6	30.8	37	44	47.8	48	46.1	42	41.1	40	36.1	29.2
(°F)	79.9	87.4	99	111	117.5	118	115	108	106	104	97	84.6
Average high °C	19.4	22.2	27.4	34.2	39.7	41	37.7	36.5	36.6	33.9	28.2	22.1
(°F)	66.9	72	81.3	93.6	103.5	105.8	99.9	97.7	97.9	93	82.8	71.8
Average low °C	4.8	7.6	12.6	18.3	24.1	27.6	27.9	27.2	24.5	17.7	10.4	6.1
(°F)	40.6	45.7	54.7	64.9	75.4	81.7	82.2	81	76.1	63.9	50.7	43
Record low °C	−4	−2	1	7	13	17	19	18.6	15.6	9	2	−1.3
(°F)	25	28	34	45	55	63	66	65.5	60.1	48	36	29.7
Average precipitation mm	16	18	23	14	9	29	96	97	20	5	2	8
(inches)	0.63	0.71	0.91	0.55	0.35	1.14	3.78	3.82	0.79	0.2	0.08	0.31

Table 2. Mean values of yield and yield related traits of coriander germplasm under open field conditions.

S.No.	Genotype	PH (cm)	Days to first cutting	Days to 2nd cutting	NL	Leaf Yield (t/ha.)
1.	GGAS-COR-67	16.71	44.2	72.1	16.9	**36.76**
2.	ECO 1212 A	16.51	43.1	70.1	14.1	**36.48**
3.	VX-315	15.31	46.8	75.2	12.2	**29.25**
4.	HSV-553	14.71	48.2	79.1	10.1	**21.80**
5.	**DILPAZEER (CHECK)**	**16.61**	**45.2**	**73.2**	**16.9**	**43.85**

PH-Plant height, NL-Number of leaves, Leaf Yield (t/ha.)

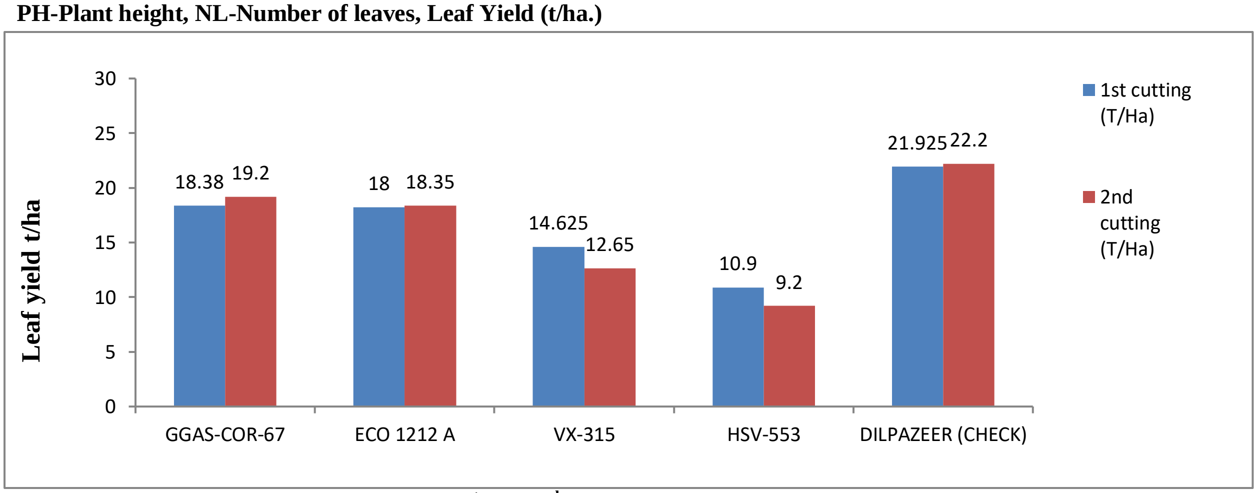

Fig 1. Leaf yield of coriander germplasm in 1st and 2nd cutting

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FIG 2. Germplasm evaluation of coriander at the experimental site

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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