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Performance of black pepper variety Sigandini and Panniyur-1 under hill zone of Karnataka in areca based mixed cropping system

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Abstract

A field experiment was conducted over two consecutive years (2020-21 and 2021-22) at a farmer's field located in Siddapur tq Uttara Kannada, which is situated in the hill zone of Karnataka, to assess the performance of black pepper varieties Sigandini and Panniyur-1 in terms of yield and quality. The results revealed that Sigandini outperformed Panniyur-1. Sigandini produced significantly higher number of laterals per m² (28.86) and number of spikes per m² (86.39) which resulted in significantly higher yield per vine (3.92 kg) and dry recovery (36.75%) compared to Panniyur-1. In contrast, Panniyur-1 had significantly higher essential oil content (2.55%), while Sigandini had significantly higher oleoresin (7.24%), piperine (5.04%) content with higher bulk density (578.36 g/l). Further, Sigandini exhibited significantly lower incidence of foot rot (8.34%) and slow wilt (8.75%) compared to Panniyur-1. The study indicated that, Sigandini is an alternative variety of black pepper for areca based mixed cropping under hill zone of Karnataka.

Keywords: Black pepper, Sigandini, Panniyur-1, hill zone

Introduction

Black pepper (*Piper nigrum* L.) is an economically important spice belonging to the family Piperaceae and is one of the oldest and widely used spices in the world. It is a woody climbing vine that is commonly cultivated as a mixed crop in arecanut and coconut gardens, and also in agroforestry systems where it is trailed on forest trees. In Karnataka, India, the cultivation of black pepper has experienced a rapid expansion due to its increasing demand, in global spice trade. However, the productivity of black pepper has been on a declining trend, which can be attributed to various factors such as varietal differences, inadequate nutrient and the incidence of pests and diseases.

Black pepper cultivation in Karnataka is mostly concentrated in the submountaneous tracts of the Western Ghats, particularly in the hilly region of *Malenadu*. Uttara Kannada is an important region for black pepper cultivation and several popular cultivars have been identified by local farmers that are well-adopted to the environmental conditions of the region. Nevertheless, the performance of these cultivars varies significantly due to differences in environmental factors such as soil type, temperature and rainfall. Hence, there is a need to scientifically evaluate these cultivars to optimize their performance with respect to yield and quality.

In this context, the present study aimed to evaluate the performance of the farmer variety Sigandini, a popular cultivar of black pepper in Uttara Kannada, in comparison with the high-yielding black pepper variety Panniyur-1 under the hill zone of Karnataka. The study aimed to identify the factors that contribute to the differences in yield and quality between these two varieties and provide insights into the mechanisms underlying their performance variation under the prevailing environmental conditions.

Material and Methods

The investigation was conducted in Kansur, Siddapura tq, Uttara Kannada district, from 2020 to 2022. The experimental area was located at 14.51° N latitude and 74.84° E longitude, with an altitude of 576 m above MSL. The selected black pepper vines were in a stable yielding stage under arecanut-based mixed cropping system at a spacing of 2.7 × 2.7 m. The vines received both organic and inorganic nutrients, as well as seaweed extracts and humic acids, to

promote their growth. During the summer months, mulching with dried grass was carried out to retain soil moisture. Observations were recorded on the growth, yield and quality characteristics during the cropping season. The essential oil content was estimated using Clevenger's apparatus and the oleoresin content was determined using the Soxhlet apparatus. The piperine content was analyzed using a gradient HPLC system, and the piperine content was detected at a wavelength of 343 nm. The percentage disease intensity (PDI) for foot rot was recorded on a 0-3 scale and expressed as a percentage, following the method of Lokesh *et al.* (2008) [4], while slow wilt was recorded on a 0-4 scale, following the method of Bhai *et al.* (2017) [1].

Result and Discussion

Growth attributes

The average performance of var Sigandini exhibited superiority in performance when compared to Panniyur-1. A higher mean plant height (6.86 m), leaf length (17.15 cm), number of runners per vine (14.21) and number of laterals per square meter (28.86) were recorded in var Sigandini while Panniyur-1 exhibited the lower mean plant height (5.79 m), leaf length (15.89 cm), number of runners per vine (10.50) and number of laterals per square meter (21.82). However, there was no significant difference in leaf width between the two varieties and it ranged from 12.09 cm (Panniyur-1) to 12.26 cm (Sigandini). The observed variation in growth characteristics can be attributed to genetic variation between the varieties grown under identical environmental conditions. The higher growth increment in Sigandini compared to Panniyur-1 may be attributed to its inherent quality of vigorous growth, leading to superior performance.

Yield attributes

Number of spikes per square meter showed a significant variation between the two varieties. The var Sigandini exhibited a higher number of spikes per square meter (86.39) compared to Panniyur-1 (78.79). However, there was no significant variation in spike length, spike weight and number of berries per spike between the two varieties. Higher fresh

and dry weight of 100 berries were recorded in Sigandini (17.40 g and 6.40 g, respectively) compared to Panniyur-1 (15.26 g and 5.17 g, respectively). The observed variation in fresh and dry weight can be attributed to the difference in starch, carbohydrate and moisture content in the berries, which was also reported by Kurian *et al.* (2002) [3].

The variety Sigandini exhibited superior performance compared to Panniyur-1, with a higher fresh yield (10.65 kg/vine) and dry yield (3.92 kg/vine) compared to Panniyur-1. The higher yield in Sigandini may be attributed to the production of higher number of laterals along with a higher number of spikes per square meter compared to Panniyur-1 in addition to the higher fresh and dry weight of black pepper berries. The results are consistent with the study conducted by Tripathi *et al.* (2018) [7], which reported significant variation in yield among black pepper varieties, wherein Arka Coorg Excel produced higher yield compared to Panniyur-1. The recovery of black pepper was significantly higher in Sigandini (36.75%) compared to Panniyur-1 (33.91%), while Panniyur-1 recorded a higher recovery of white pepper (30.71%) than Sigandini (29.17%).

Quality attributes

The quality attributes of black pepper, viz., content of essential oil, oleoresin, piperine, and bulk density, were found to vary significantly between the two varieties (Table 1). Panniyur-1 exhibited significantly higher essential oil content (2.55%) than Sigandini (2.08%), while Sigandini recorded significantly higher oleoresin content (7.24%), piperine content (5.04%) and bulk density (578.36 g/l) compared to Panniyur-1 with oleoresin content (6.45%), piperine content (4.90%) and bulk density (558.21 g/l). Earlier studies have reported significant variations in oleoresin and piperine content in black pepper varieties. The present findings are in line with the studies conducted by Buckle *et al.* (1985) [2], Kurian *et al.* (2002) [3], Radhakrishnan *et al.* (2004) [5] and Sasikumar *et al.* (2014) [6]. The results indicated that, Sigandini has superior quality attributes compared to Panniyur-1, particularly in terms of oleoresin, piperine and bulk density.

Table 1: Mean observation on growth, yield and quality attributes of black pepper varieties Sigandini and Panniyur-1 under areca based cropping system

Sl. No.	Particulars	Sigandini	Panniyur- 1	't' test
1.	Plant height (m)	6.86	5.79	5.78*
2.	Leaf length (cm)	17.15	16.26	2.57*
3.	Leaf width (cm)	12.26	12.09	0.51
4.	Number of runners vine ⁻¹	14.21	10.50	2.73*
5.	Number of laterals m ⁻²	28.86	21.82	6.32*
6.	Number of spikes per m ⁻²	86.39	78.79	3.29*
7.	Spike length (cm)	17.80	18.24	1.16
8.	Spike weight (g)	17.28	17.19	0.08
9.	No. of berries per spikes ⁻¹	94.36	92.79	0.60
10.	Fresh weight of 100 berries (g)	17.40	15.26	4.57*
11.	Dry weight 100 berries (g)	6.40	5.17	5.44*
12.	Fresh berry yield (Kg/vine)	10.65	7.92	3.79*
13.	Dry berry yield (Kg/vine)	3.92	2.70	3.66*
14.	Black pepper recovery (%)	36.75	33.89	2.34*
15.	White pepper recovery (%)	29.17	30.71	4.38*
16.	Essential oil (%)	2.08	2.55	31.01*
17.	Oleoresin (%)	7.24	6.45	38.63*
18.	Piperine (%)	5.04	4.90	2.26*
19.	Bulk density (g l-1)	578.36	558.21	4.53*

Disease reaction (PDI)

The disease reaction of Sigandini and Panniyur-1 was assessed using the percent disease incidence (PDI) for foot rot and slow wilt. Sigandini exhibited significantly lower PDI values for both foot rot (8.34%) and slow wilt (8.75%) compared to Panniyur-1 (foot rot) 24.16% and (slow wilt) 26.25% (Table 2). The lower disease incidence observed in Sigandini could be attributed to varietal feature of high root production, which enabled the plant to withstand waterlogging conditions and resist disease infection. Overall, these findings suggest that Sigandini has a better disease resistance profile compared to Panniyur-1, making it a more promising variety for cultivation in areas prone to foot rot and slow wilt.

Table 2: Disease reaction of black pepper varieties Sigandini and Panniyur-1 under areca based cropping system

Sl. No.	Particulars	Sigandini	Panniyur- 1	't' test
1.	Foot rot (%)	8.33 (16.74)	40.83 (39.68)	16.35*
2.	Slow wilt (%)	11.25 (19.57)	41.25 (39.89)	9.87*

Note: * Significant at 5%

Arc-sine transformed values are given in parenthesis

Conclusion

The current study demonstrated that the black pepper variety Sigandini outperformed Panniyur-1 in lateral and runner shoot production, yield, oleoresin and piperine content. Further, Sigandini showed field tolerance to phytophthora foot rot disease compared to Panniyur-1. These findings provide valuable insights into the potential of Sigandini as a superior variety for black pepper cultivation in the region.

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