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Evaluation of black pepper (*Piper nigrum* L.) cultivars for yield and quality parameters under hill zone of Karnataka

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Abstract

Eleven black pepper cultivars were evaluated for yield and quality traits which were grown under arecanut based cropping system during 2019-20 in Uttara Kannada (Dist.), Karnataka. The main objective was to select suitable elite cultivar of black pepper (*Piper nigrum* L.) to the malnad region of Karnataka. Among the cultivars, Cv. Kurimale was reported to produce longer spikes (22.99 cm) provided with highest number of berries (103.7) and spike weight (16.80 g). Whereas, number of spikes per sq. m area (60.08), fresh berry yield (10.67 kg/vine), dry berry yield (3.66 kg/vine) were found maximum in Panniyur-1 (check). With respect to black pepper and white pepper recovery it was found to be maximum in the Cv. Sigandini (36.98%) and Panniyur-1 (29.15%) respectively. Among the quality parameters, Panniyur-1 recorded maximum essential oil (2.95%) and oleoresin contents (8.78%), whereas, Cv. Sigandini had maximum piperine (5.1%) and bulk density (633.47 g/l).

Keywords: cultivars, spike, yield, recovery and quality

1. Introduction

Black pepper (*Piper nigrum* L.) is one of the ancient and most valuable spice ever known to the mankind and it was one of the very first item traded between India and Europe. It was so precious that they paid for it in gold, which made it to be termed as 'Black Gold'. Black pepper is renowned to be the 'King of Spices' because of its vast demand in international market and one of the world's most traded spice.

Black pepper is grown for its fruits, which is usually dried and utilized as a spice and valued for its aroma which is due to the presence of essential oil within the berries and the pungency is mainly due to its chief alkaloid piperine. It is widely used for culinary purposes and in traditional medicines (Ravindran *et al.*, 2000) [1]. It is a woody climbing perennial vine, indigene to humid tropical evergreen forests of Western Ghats of India adjacent to the Malabar coasts. In other countries like Vietnam, Malaysia, Indonesia black pepper is mainly grown as pure crop while in India it is largely grown under mixed cropping system in coconut, coffee, areca nut and tea plantation accounting for 65,518 tons with an area of 1,37,588 hectares. Apart from this it is also trailed on forest tree species like Silver oak, Jack, *Erythrina indica* etc., as live standard. In Karnataka it is cultivated in 37,750ha of land in mainly in Kodagu, Chickmagalur, Hassan, Shivamogga and Uttara Kannada districts with an annual production of 35,000 tons (Anon., 2018) [2]. Here in Karnataka Panniyur-1 is the most popular variety cultivated in all growing areas. Since Panniyur-1 variety doesn't tolerant to shade and also it is susceptible diseases especially 'quick wilt or foot rot' so, there is a need to expose the local cultivars to the outer world which are present in farmer's field that are tolerant to these aspects. However there is no much information regarding these local cultivars to the outer world. Hence, the present study was carried out to evaluate such local black pepper cultivars and identify the desirable ones to the hill zone of Karnataka.

2. Material and Methods

Experiment was carried out during 2019-20 in farmer's field around Sirsi taluk in Uttara Kannada district, which falls under hill zone (Zone-9) of Karnataka. Experimental sites had red lateritic soil with common agro climatic status and situated at an elevation of above 590m MSL. Total ten local cultivars viz., Sigandini, Huchmenasu, Huklakai Special, Keregadde Malligesara, Kurimale, Madana, SV Surya, SV Shalmala, Haavli Special and Ademane were evaluated along with a standard check variety Panniyur-1. All these black pepper vines were trained on the arecanut palm planted at a distance of 2.7m x 2.7m which serves as a live

standard. Experiment was laid out in Completely Randomized Block Design model which consists of eleven treatments, each treatments consists of three replications and each replication consists of three uniformly grown matured yielding vines. All the treatments were receiving the same cultural practices as recommended by the known authorities. Observations on yield and yield attributing characters (Laterals m⁻² area, spikes m⁻² area, spike length, spike weight, number of berries per spike, test weight of hundred berries, fresh and dry yield per vine, dry recovery of black and white pepper) and quality parameters (bulk density, essential oil, oleoresin and piperine content) along with the per cent disease incidence of quick wilt was recorded. Recorded data was statistical analyzed as explained by Panse and Sukhatme (1967)^[3].

3. Results and Discussion

3.1 Yield attributing character

Laterals per sq. m area at two meter height were highest in the Panniyur-1 (85.66) followed by Cv. Sigandini (72.66) and the lowest was seen in the Cv. Madana (44.21) (Table 1). This was attributed by the plant's vigour and its genetic character. Number of spikes per sq. m area above two m height was found substantially greater in var. Panniyur-1 (60.08) preceded by Cv. Sigandini (55.44), whereas, the Cv. Madana (34.66) recorded least number of spikes per sq. m area (Table 1). Since, the Panniyur-1 produces maximum number of laterals with longer fruiting branches. Greater number of spikes produced per unit sq. m area directly indicates that there will be a better source to sink ratio and thus the yield. It is one of the foremost important character while choosing any cultivar. This type of variation in the spike development was also explained by few other previous workers like Prasannakumari *et al.*, 2001^[4], Arya *et al.*, 2003^[5] and Bhagavantagoudra *et al.*, 2008^[6].

Cv. Kurimale (22.99 cm) was reported to produce longer spikes followed by Cv. Sigandini (14.54 cm) and Panniyur-1 (14.41 cm) and Cv. Huchmenasu (3.62 cm) produced shorter spikes. Similarly, Cv. Kurimale recorded maximum spike weight (16.80 g) followed by Cv. Ademane (15.73 g) and Cv. Sigandini (15.6 g), while, the minimum spike weight was recorded in the Cv. Huchmenasu (3.87 g) (Table 1). With regard to number of berries per spike, it was found that the Cv. Kurimale had maximum number of berries (103.92) per spike. It was mainly due to the longer spikes. Meanwhile, Cv. Huchmenasu due to its shorter spike length it produced least berries per spike (29.77) (Table 2). Hussain *et al.* (2017)^[7] studied twenty two genotypes grown under areca nut based intercropping system and revealed that the genotype SV-13 produced the spikes with higher spike weight (22.33 g) followed by var. Panniyur-1 (17.92 g), whereas, the genotype SV-8 was reported to produce the spike with lowest weight (7.90 g). It was also reported that the seasonal variation and genetic factor have direct impact on berries per spike (Ibrahim *et al.* 1988)^[8]. Earlier workers like Arya *et al.* (2003)^[5] and Tripathi *et al.* (2018)^[9] concluded that the longer spikes will produce more number of berries and hence the yield increases.

Each cultivars produce berries in spike, but they had different test weight. Among the selected cultivars Cv. Haavli Special (19.81 g) recorded highest fresh weight for hundred berries followed by Cv. Sigandini (17.53 g) and Cv. Keregadde Malligesara (17.25 g). Observed variation in test weight of berries is mainly due to the genotypic character of the respected cultivars. Meanwhile, the dry weight of hundred

berries was found to be greater in Cv. Sigandini (6.43 g) which was on par with Cv. Kurimale (6.22 g) and Cv. Keregadde Malligesara (6.10 g) (Table 2). Those genotypes which are having maximum endosperm content and minimum moisture percentage in berries will have more dry weight.

Whatever may be the characters of vine at last farmer needs the higher yield. Through this study, it was revealed that var. Panniyur-1 was reported to produce maximum fresh berry yield (10.67 kg/vine) followed by the Cv. Sigandini (9.41 kg/vine). The characters like number of hermaphrodite flowers, number of laterals, spike length, berries per spike, spikes per unit area *etc.*, were found to be more in var. Panniyur-1 and hence the fresh berry yield was also greater when compared to other cultivars. Meanwhile, Cv. Madana (4.68 kg/vine) reported to produce lowest quantity of fresh berries per vine (Table 3). This was mainly due to Cv. Madana produced very less number of laterals and spikes with low berry weight. Yield of any black pepper cultivars were decided by the spike characters (Sujatha and Namboodiri, 1995)^[10]. With regard to dry yield of berries var. Panniyur-1 (3.66 kg/ vine) superseded all other cultivars but it was on par with the Cv. Sigandini (3.42 kg/ vine) followed by Cv. Keregadde Malligesara (3.11 kg/vine) and Cv. Kurimale (2.91 kg/vine), whereas, the lowest dry berry yield was seen in the Cv. Madana (1.4 kg/ vine) (Table 3). A similar kind of result was also reported from Naik *et al.* (2013)^[11] they revealed that the black pepper variety Panniyur-1 yielded significantly high dry berries per vine (2.58 kg) which was on par with the Cv. Sirsi 1 (2.24kg/vine) and Ademane (2.21 kg/ vine) and the lowest dry berry yield was noticed in Cv. Malligesara (1.54 kg/vine). Apart from climatic and plant character yield of pepper vine also influenced by the incidence of pests and diseases *viz.*, pollu beetle and quick wilt disease.

In almost every spice that too in black pepper final dry recovery of berries plays a major role in deciding the final quantity of pepper. Each cultivar will have their own recovery rate depending upon moisture and endosperm content. In this study Cv. Sigandini (36.98%) registered highest recovery of black pepper followed by Cv. Kurimale (36.04%) and Cv. SV Surya (35.11%), while, the lowest dry recovery was seen in the Cv. Haavli Special (28.20%). Tripathi *et al.* (2018)^[8] reported that the new variety Arka Coorg Excel is having high dry recovery percentage of 37.12%. Recovery of white pepper was highest in the var. Panniyur-1 (29.15%) followed by SV Shalmala (27.19%) whereas, Cv. Madana (20.48%) was registered lowest recovery for white pepper (Table 3).

With respect to the essential oil content, variety Panniyur-1 (2.95%) was reported to yield maximum essential oil and Cv. Ademane (2.35%) was the next to best, while, the minimum was registered in Keregadde Malligesara (1.25%). A similar trend was also seen in the oleoresin content. Experimental study revealed that the recovery of oleoresin was found to be highest in case of var. Panniyur-1 (8.78%) while the lowest was recorded in Cv. Madana (4.62%). Piperine content was highest in Cv. Sigandini (5.10%) followed by Huklakai Special (4.58%) and Huchmenasu (4.53%). The lowest piperine content was recorded in Haavli Special (2.13%) (Table 4). Bulk density of the dried black pepper berries was one of the most important trait while deciding its market value and quality character. Through the research experiment it was revealed that the Cv. Sigandini (633.47 g/l) is having higher bulk density than all other cultivars followed by Cv. Huklakai Special (592.88 g/l) (Table 3). The cause for increment in the volume of the berry is due to the starch content, boldness and stage of harvest of spike (Sruthi *et al.* 2013)^[12].

Though Panniyur-1 produces maximum yield among the evaluated cultivars, it was greatly affected by the quick wilt with the record PDI of 44.40 per cent, while the Ademane and

SV Shalmala cultivars were least affected by quick wilt with PDI of 5.50 per cent (Table 5).

Table 1: Laterals and spike characters of different black pepper cultivars grown under hill zone of Karnataka

Sl. No.	Name of the cultivar	Laterals/ m ²	Spikes/ m ²	Spike length (cm)	Spike weight (g)
01	Sigandini	72.66	55.44	14.54	15.60
02	Huchmenasu	52.99	47.10	3.62	3.87
03	Huklakai Special	49.44	39.88	13.10	12.05
04	Keregadde Malligesara	59.33	43.66	13.15	14.08
05	Kurimale	66.33	51.99	22.99	16.80
06	Madana	44.21	34.66	12.70	11.53
07	SV. Shalmala	57.73	45.33	13.31	9.98
08	SV. Surya	59.44	41.33	12.59	9.18
09	Haavli Special	47.55	44.99	10.48	12.95
10	Ademane	63.66	49.66	14.25	15.73
11	Panniyur-1	85.66	60.08	14.41	15.56
	Mean	59.11	46.74	13.20	12.48
	S. Em±	2.50	2.11	0.541	0.316
	CD at 5%	7.40	6.24	1.59	0.939

Table 2: Berry characters of different black pepper cultivars grown under hill zone of Karnataka

Sl. No.	Name of the cultivar	No. of berries/spike	Fresh weight of 100 berries (g)	Dry weight of 100 berries (g)
01	Sigandini	88	17.53	6.43
02	Huchmenasu	29.77	14.61	4.96
03	Huklakai Special	74.48	15.41	5.17
04	KeregaddeMalligesara	75.59	17.25	6.10
05	Kurimale	103.92	16.75	6.22
06	Madana	66.66	17.01	4.02
07	SV. Shalmala	65.4	16.58	5.55
08	SV. Surya	61.77	15.32	5.22
09	Haavli Special	63.69	19.81	5.59
10	Ademane	81.44	15.69	5.31
11	Panniyur-1	89.25	15.34	5.20
	Mean	72.72	16.48	5.44
	S. Em±	3.59	0.46	0.13
	CD at 5%	10.61	1.38	0.40

Table 3: Yield parameters of different black pepper cultivars grown under hill zone of Karnataka

Sl. No.	Name of the cultivar	Fresh berry yield (kg/vine)	Dry berry yield (kg/vine)	Black pepper recovery (%)	White pepper recovery (%)	Bulk density (g/l)
01	Sigandini	9.41	3.42	36.98	26.08	633.47
02	Huchmenasu	6.46	2.07	33.87	24.60	583.67
03	Huklakai Special	5.30	1.76	33.13	25.91	592.88
04	Keregadde Malligesara	9.23	3.11	33.12	22.28	534.55
05	Kurimale	8.08	2.91	36.04	26.43	568.48
06	Madana	4.68	1.40	30.39	20.48	513.64
07	SV. Shalmala	8.65	2.94	33.74	27.19	565.73
08	SV. Surya	7.63	2.67	35.11	25.66	548.76
09	Haavli Special	5.49	1.52	28.20	25.26	521.8
10	Ademane	7.93	2.63	33.63	25.60	569.64
11	Panniyur-1	10.67	3.66	34.33	29.15	535.53
	Mean	7.59	2.55	33.50	25.33	560.74
	S. Em±	0.35	0.12	0.37	0.44	3.85
	CD at 5%	1.01	0.36	1.10	1.30	11.36

Table 4: Quality parameters of different black pepper cultivars grown under hill zone of Karnataka

Sl. No.	Name of the cultivar	Essential oil content (%)	Oleoresin content (%)	Piperine content (%)
01	Sigandini	1.75	7.90	5.14
02	Huchmenasu	2.25	7.00	4.52
03	Huklakai Special	2.05	5.60	4.57
04	Keregadde Malligesara	1.25	6.80	3.00
05	Kurimale	1.80	7.40	3.42
06	Madana	1.70	7.45	2.23
07	SV Shalmala	1.70	8.10	3.38
08	SV Surya	1.60	8.00	2.74

09	Haavli Special	1.40	6.30	2.13
10	Ademane	2.35	7.60	2.59
11	Panniyur-1	2.95	8.78	4.00

Table 5: Reactions of different black pepper cultivars grown under hill zone of Karnataka against Quick wilt disease

Sl. No.	Name of the cultivar	PDI of quick wilt (%)
01	Sigandini	11.11
02	Huchmenasu	27.77
03	Huklakai Special	38.88
04	Keregadde Malligesara	22.22
05	Kurimale	27.77
06	Madana	16.66
07	SV. Shalmala	5.55
08	SV. Surya	16.66
09	Haavli Special	27.77
10	Ademane	5.55
11	Panniyur-1	44.44

4. Conclusion

In the present investigation, apart from the check variety Panniyur-1, Cultivars Sigandini, Keregadde Malligesara and SV Shalmala recorded highest yield. The maximum essential oil content was recorded in Ademane and Huchmenasu, whereas, SV Shalmala, Ademane and Sigandini recorded lowest PDI for quick wilt. Overall the performance of Cv. Sigandini was superior to the rest of cultivars and hence the local cultivars are having potential to perform for better quality and yield character under hill zone of Karnataka.

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