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Integrated nutrient management for *Piper longum*

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Abstract
The experiment was conducted at Nagarjun Medicinal Plant Garden Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS). The experiment was laid out in randomize block design with the three replication. Treatments consisted of nine organic and inorganic sources of nutrient. The data in respect of growth and yield contributing characters, and piperine content as influenced by application of FYM, Neem cake and chemical fertilizer. The data revealed that the addition of neem cake along with NPK might be effected into slow release of nitrogen and was available throughout the crop growth period, which out yielded the increased dry berries yield of *Piper longum.* The piperine content was found numerically highest with the use of 100:50:50NPK kg/ ha + FYM10t/ ha.

Keywords: *Piper longum* L, Organic manure, inorganic sources, *Piperine* content

1. Introduction
Piper longum L. commercially called as long pepper and commonly known as pippali is an important spice cum medicinal plant belonging to the family Piperaceae. It is the third most important species of genus piper after black pepper and betel vine. It is a native of Indo-Malaya region and India. The main product of trade is the dry spikes of female types. The spikes contain alkaloids piperine [1] and piplartin. This forms one of the important constituents in the treatment of various human ailments under Ayurveda, Siddha and Unani medicine systems of India. So there is a great demand in Indian market coupled with shortage in supply. More than 1000 species belongs to this genus and *P. longum* is one of the most well-known species of it, including *Piper nigrum* and *Piper bettle*. *P. longum* forms an active constituent of the widely used Ayurvedic poly-herbal formulation ―Trikatu [2]. The wide spread use of this herb in different formulations as documented in ancient Ayurvedic manuscripts such as Charaka samhita [3] Susruta samhita. *P. longum* is an indigenously growing plant in India and is also cultivated in the tropical and subtropical regions of Asia and Pacific islands [4]. It is usually cultivated for its fruit, which is dried and used as spice. The plant grows into a shrub with large woody roots, numerous creeping and jointed stems that are thickened at the nodes. The leaves are without stipules and spreading in nature. Fruits are small and oval shaped berries, grown as spike. Ones matured, the spikes are collected. The dried form of spikes makes ―pippali while its root radix is known as ―pippalimula. The dietary piperine is known for its bioavailability and digestive enhancing properties. *In vitro* studies have shown the role of piperine in relieving oxidative stress by quenching free radicals and reactive oxygen species. It is known to act as an antimutagenic and antitumor agent [5]. Anti-diarrheic and anti-dysenteric properties of this spice enhance its medicinal value [6]. The pharmacological properties of this plant include anticancer, antioxidant, anti-inflammatory, hepatoprotective, immunomodulatory, antimicrobial, anti-platelet, anti-hyperlipidemic, analgesic, antidepressant, anti-amoebic, anti-obesitic, radio-protective, cardio-protective and anti-fungal activities [7]. Methanolic extract of this fruit has been reported to be involved in memory repairment and improving memory performance as shown by *in vitro* model [8]. Clinical studies have revealed the efficacy of this plant in treatment of bronchial asthma in children [9] Antidiabetic activity of the roots has also been reported. It is widely used as an important constituent in various Ayurvedic medicines to cure diseases like leprosy and tuberculosis and also used in the treatment of cough, dysponea, cardiac and spleen disorders, chronic-fever, gout, rheumatic pain etc. [10] The berries and roots of pippali are used in many pharmaceutical preparations. Berries are sweet, pungent, a stomachic, aphrodisiac, laxative, carminative,

it improves the appetite abdominal pains, fever, leucoderma, urinerary diseases etc. The present investigation was undertaken to evaluate the effect of intergrated nutrient management on the yield of *Piper longum*.

Material and Method

The experiment was conducted at Nagarjun Medicinal Plant Garden Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS). The experiment was laid out in randomize block design with the three replication. Treatments consisted of nine organics and inorganic sources of nutrient. The crop was subjected to recommended package of agronomic practices to obtain a healthy crop. The net plot is converted in to quintal per hectare by using hectare factor. The three years pooled data is discussed in the present paper.

Treatment details

It includes nine organic treatments viz. T1-Control, T2-100:50:50 Kg NPK/ha, T3- 50:25:25 Kg NPK/ha, T4- FYM 10t/ha, T5- Neem cake 10q/ha,T6- 100:50:50NPK kg/ha + FYM 10t/ha, T7- 100:50:50 NPK kg/ha + Neem cake 10q/ha, T8-NPK 50:25:25 kg/ha+ 10t FYM/ha, T9-NPK 50:25:25 Kg/ha + 10q Neem cake/ha. Yield recorded during the investigation and data analyzed statically.

Result and Discussion

The data in respect of growth and yield contributing characters, and piperine content as influenced by application of FYM, Neem cake and chemical fertilizer are present in Table-1.

The data revealed that the application of nutrients through FYM, neemcake and chemical fertilizers significantly influenced the growth as well as yield of *Piper longum.* However, height and piperine content was not significantly influenced by nutrient application treatments.

Number of berries was significantly highest with the application of 100:50:50 NPK kg/ha + Neem cake 10q/ ha (T7). Dry weight of berries was recorded significantly more in 100:50:50 NPK kg/ ha+ Neem cake 10q/ ha (T7) which was at par with and 100:50:50NPK kg/ ha + FYM10t/ ha (T6). The addition of neem cake along with NPK might be effected into slow release of nitrogen and was available throughout the crop growth period, which out yielded the increased dry berries yield of *Piper longum.*

The piperine content was found numerically highest in 100:50:50NPK kg/ ha + FYM10t/ ha (T6). However, total piperine yield was significantly superior with (T7) 100:50:50NPK kg/ ha + Neemcake 10 q /ha which was at par with100: 50:50 NPK kg/ ha+ Fym10t\ha (T6).

Table 1: Growth, yield and quality of *Piper longum* as influenced by different treatments

Treatments	Height (cm)	No. of berries/plant	No. of berries/plot	Dry wt. of berries g/ plant	Dry wt. of berries Kg/ ha	Piperine content %	Piperine kg/ ha
T1 -Control	80.83	41.66	475	7.53	241.95	5.41	13.09
T2-100:50:50 Kg NPK/ha	106.4	45.27	670	15.97	341.15	5.67	19.34
T3- 50:25:25 Kg NPK/ha	103.17	41.92	498	10.29	314.92	5.57	17.54
T4- FYM 10t/ ha	85.033	43.60	494	9.86	261.16	5.66	14.78
T5- Neem cake 10q /ha	89.63	47.30	552	10.85	273.38	5.44	14.87
T6 100:50:50NPK Kg/ ha + FYM10t /ha	106.40	52.25	592	13.83	397.17	5.75	22.83
T7- 100:50:50 NPK kg /ha + Neem cake 10q /ha	108.37	63.5	783	15.75	435.82	5.65	24.62
T8-NPK 50:25:25 kg/ ha + FYM 10 t/ha	95.77	60.9	541	11.53	354.06	5.71	20.22
T9-NPK 50:25:25 Kg/ ha + Neem cake 10q/ha	81.40	48.01	592	11.9	342.37	5.43	18.59
SE (m) ±	8.61	1.78	36.5	.968	13.22	0.11	1.45
CD(P=0.05)	NS	5.21	109.64	1.368	39.63	NS	4.36

Conclusion

Application of NPK 100:50:50 kg + Neemcake 10q per hectare recorded significantly more dry berries yield and piperine yield followed by application of NPK 100:50:50 kg + 10 t FYM/ ha.

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