J. Farm Sci., 38(2): (110-112) 2025

RESEARCH PAPER

Effect of different organic sources on growth, yield and economics of buckwheat (*Fagopyrum esculentum* Monech)

MOHAMMED YASEEN[1*], U. K. SHANWAD[1], U. K. HULIHALLI[1] AND K. K. MATH[2]

[1]Department of Agronomy, [2]Department of Soil Science & Agril. Chemistry, College of Agriculture, Dharwad -580 005
Universityof Agricultural Sciences, Dharwad 580 005, India
*E-mail: yaseen.alur111@gmail.com

(Received: August, 2023 ; Accepted: June, 2025)

DOI: 10.61475/JFS.2025.v38i2.03

Abstract: A field experiment was conducted at ICAR – KVK, Dharwad during *rabi* season of 2022-23 to find out the effect of organic nutrient management on growth, yield and economics of buckwheat. The results showed that among the treatments, application of RDF (30:15:15 kg $N:P_2O_5:K_2O$ ha^{-1}) through inorganic fertilizers has recorded significantly higher growth and yield parameters *viz*., plant height (65.6 cm), total dry matter production per plant (7.93 g), number of clusters per plant (11.87), seed weight per plant (1.89 g), test weight (28.95 g), grain (666 kg ha^{-1}) and straw yield (1263 kg ha^{-1}) as compared to the other treatments. Among the organic sources significantly higher grain yield was recorded with application of pongamia cake (602 kg ha^{-1}) followed by neem cake (596 kg ha^{-1}) and vermicompost (593 kg ha^{-1}). Significantly higher net returns (₹ 26,170 ha^{-1}) and B:C ratio (2.74) were obtained with the treatment which received RDF alone.

Key words: Buckwheat, Nutrient management, Organic sources, Pseudocereals

Introduction

Buckwheat is one of the important pseudocereal crop mainly consumed for its health benefits. It belongs to the family polygonaceae. The leaves and flowers of buckwheat contains a glycoside called rutin, which has medicinal properties as it possess highest antioxidant activity as compared to other cereals (Kreft *et al*., 2006). It controls blood sugar, reduces blood pressure, lowers cholesterol level in blood, prevents fat accumulation and constipation. Buckwheat is cultivated on 2.4 million hectares of land worldwide, with production of 2.4 million tonnes and average productivity of 1000 kg per hectare (Anon., 2018). In India it is cultivated in an area of 60,000 hectare with a production of 35,000 tonnes and an average productivity of 53 g per hectare (Anon., 2015).

Buckwheat is one of the important crop which grows well under organic farming condition. Farmers of north-eastern hill region of India do not apply chemical fertilizers to this crop, only they apply basal application of about 1.5-2.0 t ha^{-1} of farmyard manure (Phoghat and Sharma, 2000). Organic manures directly provides macro and micronutrient and indirectly helps in improving the physical, chemical and biological properties of soils. Organic matter is the heart of fertile soil as it increases cation and anion holding capacity of soil. Organic manuring also improve the efficiency of nitrogenous fertilizers in acidic soils. Buckwheat being a nutritive crop having many health benefits, very well suited to grow organically so that people consuming it for health benefits can consume chemical free healthy food. So, in order to compare organic cultivation of buckwheat with conventional farming and to find out the best organic source for buckwheat cultivation, the current experiment was planned.

Material and methods

A field experiment was conducted at ICAR-KVK, University of Agricultural Sciences, Dharwad during *rabi* 2022-23. The soil type of the experimental site was sandy loam in texture and it belonged to the order *Alfisols*. The soil was neutral in pH (7.14) with normal electrical conductivity (0.28 dS m^{-1}). It was low in available nitrogen (244.5 kg ha^{-1}), medium in phosphorus (21.5 kg ha^{-1}) and available potassium (249.4 kg ha^{-1}). The total rainfall received during the crop growth period (3rd December to 11th February) was 3.2 mm during the second week of December. The experiment was laid out in a randomized complete block design (RCBD) which consisted of nine treatments & was replicated thrice with different organic sources. The treatments comprising of 100 per cent nitrogen were supplied through organic manures *viz*., farmyard manure, vermicompost, green manure, sheep manure, poultry manure, neem cake and pongamia cake. These organic manures were compared with recommended dose of fertilizers and absolute control. The required quantities of organic manures were applied in respective plots as per the treatments and incorporated into soil one week before sowing the crop. All the treatments were applied so as they supply 30 kg N ha^{-1}. The furrows were opened, seeds are sown not more than 5 cm deep and covered with soil. The irrigation was scheduled with sprinkler system after sowing and total of four irrigations were provided (at each irrigation 5 cm depth was maintained) at 15-20 days interval.

Results and discussion

Significantly higher growth parameters *viz*., plant height at harvest (65.6 cm) and total dry matter production (7.93 g $plant^{-1}$) were recorded in treatment which received RDF. However, it was found on par with treatments which received pongamia cake (62.3 cm and 7.52 g) neem cake (60.9 cm and 7.37 g) and vermicompost (59.6 cm and 7.29 g). These findings are in accordance with Divyashree *et al* (2018), Harika *et al.* (2019) and Ramya *et al.* (2020). Similarly, significantly higher yield attributes *viz*., number of clusters per plant (11.87), seed weight

Table 1. Growth and yield components of buckwheat as influenced by different organic sources

Treatments	Plant height(cm)	Dry matter production (g)	Number of clusters per plant	Seed weight per plant(g)	Test weight (g)
T_1: 100% N through FYM	50.8^{cd}	6.88^{bc}	9.57^{c}	1.23^{cd}	26.30^{c}
T_2: 100% N through vermicompost	59.6^{ab}	7.29^{ab}	10.93^{ab}	1.75^{a}	28.35^{ab}
T_3: 100% N through green manure	49.7^{cd}	6.84^{bc}	9.13^{c}	1.16^{d}	26.20^{c}
T_4: 100% N through sheep manure	55.9^{bc}	6.99^{bc}	10.27^{bc}	1.47^{b}	27.18^{bc}
T_5: 100% N through poultry manure	55.7^{bc}	6.89^{bc}	10.13^{bc}	1.35^{bc}	27.05^{bc}
T_6: 100% N through neem cake	60.9^{ab}	7.37^{ab}	11.03^{ab}	1.78^{a}	28.57^{a}
T_7: 100% N through pongamia cake	62.3^{ab}	7.52^{ab}	11.23^{ab}	1.79^{a}	28.72^{a}
T_8: RDF	65.6^{a}	7.93^{a}	11.87^{a}	1.89^{a}	28.95^{a}
T_9: Absolute control	46.7^{d}	6.17^{c}	7.47^{d}	0.93^{c}	25.97^{c}
S. E m±	2.34	0.31	0.43	0.06	0.45

Means followed by the same letter(s) within the column did not differ significantly by DMRT (p = 0.05)

Table 2. Grain yield, straw yield and economics of buckwheat cultivation as influenced by different organic sources

Treatment details	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Net returns (₹ ha^{-1})	B:C ratio
T_1: 100% N through FYM	412.4^{cd}	826.6^{c}	8,484^{d}	1.38
T_2: 100% N through vermicompost	593.5^{a}	1148.4^{a}	19,412^{b}	1.79
T_3: 100% N through green manure	403.2^{d}	811.2^{c}	12,412^{cd}	1.71
T_4: 100% N through sheep manure	503.5^{b}	1007.1^{b}	15,017^{bc}	1.67
T_5: 100% N through poultry manure	487.3^{bc}	975.8^{b}	15,064^{bc}	1.72
T_6: 100% N through neem cake	595.7^{a}	1151.2^{a}	18,489^{b}	1.72
T_7: 100% N through pongamia cake	602.1^{a}	1162.2^{a}	14,156^{bcd}	1.47
T_8: RDF	665.8^{a}	1262.9^{a}	26,170^{a}	2.74
T_9: Absolute Control	308.1^{e}	628.5^{d}	7,986^{d}	1.71
S.E m±	25.4	44.2	1825	-

Means followed by the same letter(s) within the column did not differ significantly by DMRT (p = 0.05)

per plant (1.89 g) and test weight (28.95 g) were recorded with the application of RDF (T_8) (Table 1). Joshi *et al.* (2016) also noted similar kind of results. It may be due to availability of major nutrients to plant at early stages which might have enhanced early root growth and cell multiplication and accumulation of photosynthates and might have resulted in higher plant height, higher dry matter production and ultimately yield parameters.

Among the organic sources application of pongamia cake (T_7) recorded significantly higher plant height at harvest (62.3 cm) and total dry matter production per plant (7.52 g) at harvest. It was followed by neem cake (T_6) and vermicompost (T_2). These findings are in accordance with Navlakhe *et al*. (2009) and Veena *et al.* (2017). Similarly, significantly higher number of clusters per plant (11.23), seed weight per plant (1.79 g) and test weight (28.72 g) and it was on par with treatments which received neem cake (T_6) and vermicompost (T_2) (Table 1). Organic cakes (pongamia cake and neem cake) and vermicompost are rich in major and micronutrients and these also contain high amount of organic carbon, which supports beneficial soil microbes, which helped in release of nutrients from unavailable to available form. Application of oil cakes and vermicompost might have resulted in rapid release of nutrients to cope up with the crop demand, which resulted in higher growth and yield parameters. These findings are in accordance with Hegde *et al.* (2015), Babu *et al.* (2016) and Salma and Sonia (2021). Application of RDF (T_8) recorded significantly higher grain yield (665.8 kg ha^{-1}) and straw yield (1262.9 kg ha^{-1}) as compared to rest of the treatments. Availability of major nutrients to plant at early stages resulted in higher dry matter production, more number of leaves and higher leaf area which in turn increased photosynthesis resulted in accumulation of photosynthates ultimately resulted in higher grain and straw yield. These findings are in accordance with Joshi *et al.* (2016), Harika *et al.* (2019), Ramya *et al.* (2020).

Among the organic sources application of pongamia cake (T_7) recorded significantly higher grain yield (602.1 kg ha^{-1}) and straw yield (1162.2 kg ha^{-1}) (Table 2) and it was on par with treatments which received neem cake (T_6) and vermicompost (T_2). Quick release of nutrients in cakes (neem and pongamia cake) supported good early growth which resulted in higher grain and straw yield. These findings are in accordance with Osman *et al*. (2009), Shivakumar *et al.* (2011) and Vittal *et al.* (2021). Significantly higher net returns (₹ 26,170) and B:C (2.74) ratio was recorded with RDF followed by vermicompost (Table 2). Cost of cultivation was less for RDF as compared to organic treatments as organic manures has to be applied in bulk which increases cost of cultivation.

Conclusion

Buckwheat being a short duration crop with little nutritional requirement, application of RDF (30:15:15 kg N, P_2O_5 and K_2O ha^{-1}), has recorded significantly higher growth and yield parameters. Among the organic sources pongamia cake performed better followed by neem cake and vermicompost. Economically RDF is better than other organic sources as organic sources needs to be applied in bulk which increases the cost of cultivation.

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