J. Farm Sci., 35(4): (420-422) 2022

RESEARCH PAPER

Productivity and economic feasibility of buckwheat intercropping with chickpea under Northern Transition Zone of Karnataka

S. MANOJKUMAR, R. BASAVARAJAPPA, B. S.YENAGI AND B. G. NAGAPPA

Department of Agronomy, College of Agriculture, Dharwad
University of Agricultural Sciences, Dharwad - 580 005, Karnataka, India
E-mail: manojkumar20140663014@gmail.com

(Received: September, 2022 ; Accepted: November, 2022)

Abstract: A field study was conducted to analyse the productivity and economic feasibility of buckwheat intercropping with chickpea under Northern Transition Zone of Karnataka at The Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka during *rabi* 2021. The results revealed that sole buckwheat produced a grain yield that was noticeably higher (590 kg ha^{-1}). Among the intercropping systems buckwheat grain yield was higher with chickpea + buckwheat at 4:4 (359 kg ha^{-1}). Higher harvest index (36.09 %) was attained with sole buckwheat. Sole chickpea recorded significantly higher chickpea grain yield (1937 kg ha^{-1}) when compared to all other treatments. Chickpea + buckwheat in 3:1 row ratio was shown to have a significantly higher grain yield (1768 kg ha^{-1}), which was comparable to chickpea + buckwheat at 2:1 (1655 kg ha^{-1}) and 4:2 (1654 kg ha^{-1}) row ratio. Significantly higher net returns (₹ 63334 ha^{-1}) and B:C ratio (2.70) was recorded with 4:2 row ratio of chickpea and buckwheat. However, on par results were obtained with 3:1 and 2:1 row ratio of chickpea + buckwheat and sole chickpea.

Key words: Buckwheat, Chickpea, Grain yield, Harvest index, Haulm yield

Introduction

A cool temperature, annual grain and pseudocereal, buckwheat (*Fagopyrum esculentum* Moench) is a member of the polygonaceae family. The Anglo-Saxon terms boch (beech) and whoet (wheat), which resemble the beechnut, are the roots of the name buckwheat. The distribution and species diversity of buckwheat in the Himalayan region showed significant variance. It is a product of temperate East Asia (Ohnishi, 1998). It is grown on 2.4 million ha of land worldwide, producing 2.4 million tonnes annually with an average productivity of 1,000 kg ha^{-1}. Russia leads all other buckwheat-growing nations in terms of both area and production (1.12 mha and 1.19 mt, respectively), followed by China and Ukraine. France has the best productivity in the world (3735 kg ha^{-1}) (Anon., 2018). It is mostly found in the mountainous parts of Jammu and Kashmir, Uttarakhand in the north, and West Bengal, Meghalaya, Manipur, Arunachal Pradesh in the North-East India and Nilgiris and Palani hills in the south.

Intercropping has a huge potential and multiple advantages, since most of the research work is concentrated on sequential cropping system, there is a need for more research to understand the functioning of intercrops in a better way and to develop more and more options for intercropping that are compatible with present farming systems targeting on better and sustainable harvest (Maitra *et al*., 2019). In a comprehensive review of our agricultural system, one should look at yields as well as the cost of the inputs used to get them and their environmental impact. Intercropping could reduce the need for non-renewable resource consumption in modern agriculture or use those resources more effectively (Horwith, 1985).

Material and methods

A field study was conducted to analyze the productivity and economic feasibility of buckwheat intercropping with chickpea under Northern Transition Zone of Karnataka at The Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka during *rabi* 2021. It is located at 15^0 49' North latitude, 74^0 99' East longitude and 678 m above mean sea level (MSL). The research was laid out in randomized complete block design with three replications consisting of eight treatments under different row ratios. The treatment includes six different row ratios of chickpea + buckwheat *viz*., chickpea + buckwheat at 1:1, 2:1, 3:1, 2:2, 4:2 and 4:4 with sole chickpea and sole buckwheat comprising total of eight treatments. The soil of the experimental site was clayey in nature having maximum clay content (51.75 %). The soil pH was 7.86 with EC of 0.26 dS m^{-1} and organic carbon content was 0.52 per cent.

Results and discussion

Sole buckwheat has recorded significantly higher grain and straw yield (590 and 1046 kg ha^{-1}, respectively) over all other treatments (Table 1). An increase to an extent of 64.34 per cent of grain yield of sole buckwheat over 4:4 row ratio of chickpea + buckwheat was observed. The higher grain yield and straw yield of sole buckwheat was mainly due to higher plant population, better vegetative growth, optimum spacing, less habitat disturbance and less interspace competition. There was no significant difference between the treatments with respect to harvest index of buckwheat. Higher grain yield and straw yield of chickpea (1937 and 2370 kg ha^{-1}, respectively) was observed with sole chickpea

and grain yield was found on par with chickpea + buckwheat at 3:1 row ratio (Table 2). This may be due to higher plant population, lesser intercrop competition, higher photosynthetic area, higher light interception and optimum spacing available for crop growth. This was also in accordance with the findings of Alam (2015), Thakur *et al*. (2000), Shivakumar and Yadahalli (1995) and Shankaralingappa and Hegde (1992).

Table 1. Grain yield, straw yield and harvest index of buckwheat as influenced by different row ratios of chickpea with buckwheat

Treatment	Treatment details	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
T_1	Chickpea + Buckwheat (1:1)	294^{bc}	563^{b}	34.29^{a}
T_2	Chickpea + Buckwheat (2:1)	204^{bc}	360^{c}	35.89^{a}
T_3	Chickpea + Buckwheat (3:1)	134^{c}	279^{d}	32.48^{a}
T_4	Chickpea + Buckwheat (2:2)	291^{bc}	560^{b}	33.63^{a}
T_5	Chickpea + Buckwheat (4:2)	242^{bc}	380^{c}	37.32^{a}
T_6	Chickpea + Buckwheat (4:4)	359^{b}	584^{b}	35.91^{a}
T_8	Sole buckwheat	590^{a}	1046^{a}	36.09^{a}
S.Em±		98	26	6.61

Means followed by same lower case letter/s in a column do not differ significantly by DMRT (P=0.05)

Table 2. Grain yield, haulm yield and harvest index of chickpea as influenced by different row ratios of chickpea and buckwheat

Treatment	Treatment details	Grain yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
T_1	Chickpea + Buckwheat (1:1)	1199^{c}	1472^{c}	44.74^{a}
T_2	Chickpea + Buckwheat (2:1)	1655^{b}	1879^{b}	46.84^{a}
T_3	Chickpea + Buckwheat (3:1)	1768^{ab}	1956^{b}	47.54^{a}
T_4	Chickpea + Buckwheat (2:2)	1162^{c}	1366^{c}	45.87^{a}
T_5	Chickpea + Buckwheat (4:2)	1654^{b}	1888^{b}	46.68^{a}
T_6	Chickpea + Buckwheat (4:4)	1128^{c}	1352^{c}	45.47^{a}
T_7	Sole chickpea	1937^{a}	2370^{a}	45.00^{a}
S.Em±		93	111	1.24

Means followed by same lower case letter/s in a column do not differ significantly by DMRT (P=0.05)

Table 3. Chickpea equivalent yield, buckwheat equivalent yield, land equivalent ratio and area time equivalent ratio as influenced different row ratios of chickpea with buckwheat

Treatment	Treatment details	CEY(kg ha^{-1})	BEY(kg ha^{-1})	LER	ATER
T_1	Chickpea + Buckwheat (1:1)	1538^{b}	1333^{b}	1.04^{a}	0.53^{b}
T_2	Chickpea + Buckwheat (2:1)	1890^{a}	1638^{a}	1.10^{a}	0.60^{b}
T_3	Chickpea + Buckwheat (3:1)	1924^{a}	1667^{a}	1.03^{a}	0.59^{b}
T_4	Chickpea + Buckwheat (2:2)	1499^{b}	1299^{b}	1.03^{a}	0.52^{b}
T_5	Chickpea + Buckwheat (4:2)	1933^{a}	1676^{a}	1.16^{a}	0.63^{b}
T_6	Chickpea + Buckwheat (4:4)	1542^{b}	1337^{b}	1.11^{a}	0.55^{b}
T_7	Sole chickpea	1937^{a}	1811^{a}	1.00^{a}	1.00^{a}
T_8	Sole buckwheat	681^{c}	590^{c}	1.00^{a}	1.00^{a}
S.Em±		144	130	0.15	0.06

Means followed by same lower case letter/s in a column do not differ significantly by DMRT (P=0.05)

Table 4. Economics of intercropping system as influenced by different row ratios of chickpea with buckwheat

Treatment	Treatment details	Cost of cultivation (₹ ha^{-1})	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	B-C ratio
T_1	Chickpea + Buckwheat (1:1)	36712	79988^{b}	43275^{b}	2.18^{bc}
T_2	Chickpea + Buckwheat (2:1)	37193	98300^{a}	61106^{a}	2.64^{ab}
T_3	Chickpea + Buckwheat (3:1)	37270	99976^{a}	62705^{a}	2.68^{a}
T_4	Chickpea + Buckwheat (2:2)	36712	77884^{b}	41171^{b}	2.12^{c}
T_5	Chickpea + Buckwheat (4:2)	37193	100528^{a}	63334^{a}	2.70^{a}
T_6	Chickpea + Buckwheat (4:4)	36712	80196^{b}	43483^{b}	2.18^{bc}
T_7	Sole chickpea	38881	100724^{a}	61842^{a}	2.59^{a-c}
T_8	Sole buckwheat	25115	35400^{c}	10284^{c}	1.41^{d}
S.Em±			7475	7475	0.20

Means followed by same lower case letter/s in a column do not differ significantly by DMRT (P=0.05)
Note: Minimum support price for chickpea - ₹ 5200 q^{-1} and market price for buckwheat - ₹ 6000 q^{-1}

Significantly higher chickpea equivalent yield (CEY) (1937 kg ha^{-1}) was observed with sole chickpea when compared to all other treatments. Among the intercropping systems significantly higher chickpea equivalent yield (1933 kg ha^{-1}) was recorded with chickpea + buckwheat at 4:2 row ratio which was on par with chickpea + buckwheat at 3:1 (1924 kg ha^{-1}) row ratio and chickpea + buckwheat at 2:1 (1890 kg ha^{-1}) row ratio. Sole chickpea was recorded significantly higher (1811 kg ha^{-1}) buckwheat equivalent yield (BEY) and was on par with 4:2, 3:1 and 2:1 row ratio of chickpea + buckwheat. Among the intercropping systems 4:2 row ratio of chickpea + buckwheat was recorded higher (1676 kg ha^{-1}) BEY and it was on par with 3:1 (1667 kg ha^{-1}) and 2:1 (1638 kg ha^{-1}) row ratio of chickpea + buckwheat. There was no significant difference between the treatments with respect to LER as influenced by different row ratios of chickpea with buckwheat. However, numerically higher LER (1.16) was recorded with chickpea + buckwheat at 4:2 row ratio. Similar results were observed by Tripathi *et al*. 2005, Mohapatra and Haldar, 1998, Parida *et al*. 1989 and Pradhan and Ghosh, 1988. Significantly higher (1.00) ATER was recorded in sole crops of chickpea and buckwheat. Among the intercropping systems higher ATER (0.63) was observed with 4:2 row ratio of chickpea + buckwheat (Table 3). When looked into economics of different row ratios of chickpea + buckwheat, 4:2 row ratio exhibited superior results with respect to net returns (₹ 63,334 ha^{-1}) and B-C ratio (2.70) over 1:1, 2:1, 3:1, 2:2 and 4:4 row ratios of chickpea + buckwheat. However, 3:1 and 2:1 row ratio of chickpea and buckwheat and sole chickpea were noticed on par with 4:2 row ratio of chickpea + buckwheat (Table 4).

Conclusion

Hence, the study indicated 4:2 ratio of chixkpea + buckwheat as the best intercropping system.

References

Anonymous, 2018, www. faostat. fao.org. Area, production and productivity of buckwheat.

Alam M I, 2015, Intercropping efficiency of chickpea (*Cicer arietinum*) based intercropping system under rainfed condition of Bihar. *Annals of Agricultural Res*earch, 36(4): 370-376.

Horwith B, 1985, A role of intercropping in modern agriculture. *Bioscience*, 35(5): 286-291.

Maitra S, Palai J B, Manasa P and Kumar D P, 2019, Potential of Intercropping system in sustainingcrop productivity. *International Journal of Agriculture, Environment and Biotechnology*, 12(1): 39-45.

Mohapatra A K and Haldar J, 1998, Intercropping of soybean and rice bean with rice and ragi under different planting patterns. *Annals of Agricultural Research,* 19(1):114-115.

Ohnishi O, 1998, Search for the wild ancestor of buckwheat III. The wild ancestor of cultivated common buckwheat and of tartary buckwheat. *Economic Botony*, 52(2): 123-133.

Parida D, Dikshit V N, Satpathy D and Mahapatra P K, 1989, Genotype compatabiltiy study in pigeonpea + finger millet intercropping system. *Indian Journal of Dryland Agriculture Research and Development,* 4(1): 50-55.

Pradhan A C and Ghosh D C, 1988, Mixed cropping of finger millet with blackgram and greengram. *Indian Journal of Agronomy,* 33(3): 318-320.

Shankaralingappa B C and Hegde B R, 1992, Intercropping studies in finger millet with pigeonpea and field bean. *Mysore Journal of Agricultural Sciences,* 26: 248-253.

Shivakumar B G and Yadahalli Y H, 1995, Economics of intercropping in finger millet under late sown dryland conditions. *Farming Systems,* 11(1-2): 1-7.

Thakur N S, Pannase S K and Sharma R S, 2000, Production potential of gram based intercropping systems under rainfed condition. *Indian Journal of Agronomy,* 45(3): 534-539.

Tripathi H N, Chand S and Tripathi A K, 2005, Biological and economical feasibility of chickpea and Indian mustard cropping system under varying levels of phosphorous. *Indian Journal of Agronomy,* 50(1): 31-34.