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Effect of sowing window and nutrient management on blackgram under rice fallow condition

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Abstract
Field experiment was conducted at wetlands farm of Tamil Nadu Agricultural University, Coimbatore during January to April 2019 to study the effect of sowing window and nutrient management on blackgram under rice fallow condition. The result revealed that blackgram under rice fallow condition is performing well to graded doses of nutrient. The experiment was laid out in a split plot design with treatment combination of main plot M_1- sowing next day after harvest, M_2- sowing 15 days after harvest and in sub plot four nutrient levels N_1-0%, N_2-50%, N_3-75% and N_4-100% of RDF replicated thrice. The result revealed that sowing 15 days after rice harvest combined with 100% RDF recorded better growth, yield parameter and yield in rice fallow blackgram. However, sowing 15 days after rice harvest combined with 75% RDF were on par with sowing 15 days after rice harvest combined with 100% RDF.

Keywords: Blackgram, date of sowing, nutrient management, rice fallow crop

Introduction
Pulses are commonly known as food legumes, which are secondary to cereals in production and consumption in India. The United Nations, declared 2016 as "International Year of Pulses" (IYP) to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition. Pulses are an integrated part to many diets across the globe and they have great potential to improve human health, conserve our soil, protect the environment and contribute to global food security. Blackgram is scientifically known as *Vigna mungo* (L.) and commonly known as urd in India. It is a tropical leguminous plant. Blackgram is one of the legume crops which has its own importance due to high nutritional value of seeds as a human food and rich feed for cattle.

No till or zero tillage is an important component of conservation agriculture to produce crops at low cost with profound effect on natural resources such as water and soil (Gangwar *et al.*, 2013) [2]. Besides growing of this crop on rice fallow, heavy weed infestation is the dominant reason for a low yield of black gram. In general, yield loss due to uncontrolled weed growth in black gram ranges from 27 to 100%. Blackgram is less competitive against many weeds during early stage of crop and the most sensitive period of weed competition is between 15 to 45 days after sowing.

The optimum time of sowing ensures the complete harmony between the vegetative and reproductive phases and helps in realizing the potential yield. Time of sowing is an important non- monitory input for achieving the maximum yield. As many as non- monetary input utility we can increase the profitability and reduce cost of cultivation. Identification of best time of sowing is need of the hour in rice fallow crop to increase resource use efficiency and profit.

In the rice fallow crop sequence, the first crop is fertilized and the fallow pulse crop is grown without any fertilizer application. In this case, the pulses utilize the residual nutrients effectively for the growth and development, whereelse yield will be significantly lower compare to conventional pulse cultivation. Among several management practices, nutrient management must be sound for achieving production target on sustainable basis. Nutrient management has played very significant role in providing the physical condition of soil and supply all the macro and micro nutrients which are required by crop for balanced nutrition (Gaur *et al.*, 1990) [3]. Keeping this view, the present study was taken to identify best date of sowing and nutrient management practices for rice fallow blackgram to get maximum yield and profitability in summer season.

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Material and Methods

The field experiment was conducted in 'B8' block of the wetlands farm, Tamil Nadu Agricultural University, Coimbatore at 11^0 N latitude and 77^0 E longitude with an altitude of 426.7 m above MSL during January to April 2019 to study the effect of sowing window and nutrient management on blackgram (VBN 8) under rice fallow condition. The soil of the experimental site was clayey loam in texture with alkaline pH, medium in organic carbon content, low in available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in a split plot design with treatment combination of main plot M_1. Sowing next day after rice harvest, M_2. Sowing 15 days after rice harvest and in sub Plot four nutrient levels N_1 0%, N_2 50%, N_3 75% and N_4 100% of RDF (25: 50: 25 NPK kg ha^{-1}) replicated thrice with a recommended spacing of 25 × 10 cm. Rice crop was raised as bulk without any treatments with normal recommended package of practice during rabi season (2018. After harvest of rice next day glyphosate spray was given in the morning. Immediately after that blackgram was sown under zero tillage conditions by dibbling two seeds per hill at a depth of 2 cm with the help of pointed bamboo peg and same process repeated for next sowing, 15 days after rice harvest. Thinning and gap filling was done with utmost care at 10 DAS by keeping one seedling hill^{-1}. As per the treatment schedule, NPK (25:50:25 NPK kg ha^{-1} RDF) was applied full dose as basal for all the treatments. The crop was maintained by adopting recommended package of practices. Need based plant protection measures were taken up during crop growth period. The biometric observations on growth, physiological, yield attributes and yield was recorded and analyzed as per standard statistical procedures.

Results and Discussion
Growth parameters

Data on mean plant height (cm) and number of branches plant^{-1} at 20, 40 and at harvest were given in Table 1 and 2. Growth parameters of blackgram was not significantly influenced by different dates of sowing after the rice harvest.

The level of different nutrients significantly influenced the plant height at 40 DAS and at harvest. The taller plant height (45.20 and 56.85 cm) was noted in 100% RDF (N_4) at 40 DAS and at harvest stage respectively, which was on par with 75% RDF (N_3). Shorter plant height was recorded in 0% RDF (N_1). Similar trend was found in number of branches plant^{-1} and more number of branches (5.30 and 5.75) was observed in 100% RDF (N_4) at 40 DAS and at harvest stage respectively. It might be due to better availability of nutrients to the crop and less competition for resources as evident from the beneficial effects on the crop growth. Application of optimum quantity of nutrients might have increased the use efficiency of added nutrients and supply it continuously to the plant throughout the crop growth period and promoted various physiological activities in plant which are considered being indispensable for proper growth and development. These results are conformity with the finding of Tomar *et al.,* (2015) [8].

Interaction between date of sowing after rice harvest and fertilizer levels has no notable difference in growth parameters of blackgram VBN 8.

Table 1: Effect of different dates of sowing and nutrient management practices on plant height (cm) of rice fallow blackgram 2019

Treatment	20 DAS			40 DAS			At harvest		
	M_1	M_2	Mean	M_1	M_2	Mean	M_1	M_2	Mean
N_1	19.10	18.40	18.75	35.20	38.70	36.95	48.80	49.20	49.00
N_2	19.80	20.50	20.15	42.50	42.90	42.70	53.40	54.80	54.10
N_3	20.10	20.90	20.50	43.80	44.10	43.95	55.00	55.30	55.15
N_4	21.30	21.60	21.45	45.00	45.40	45.20	56.10	57.60	56.85
Mean	20.08	20.35		41.63	42.78		53.33	54.23	
	M	N	M x N	N x M	M	N	M x N	N x M	M	N	M x N	N x M
SEd	0.60	0.60	1.16	0.85	1.31	1.30	2.53	1.83	1.27	1.76	3.07	2.49
CD (p=0.05)	NS	1.30	NS	NS	NS	2.83	NS	NS	NS	3.84	NS	NS

Main plot: Date of sowing; M1: Sowing next day after rice harvest, M2: Sowing 15 days after rice harvest
Sub plot: Nutrient management; N_1 : 0% RDF, N_2 : 50% RDF, N_3 : 75% RDF, N_4 : 100% RDF

Table 2: Effect of different dates of sowing and nutrient management practices on number of branches plant^{-1} of rice fallow blackgram 2019

Treatment	20 DAS			40 DAS			At harvest		
	M_1	M_2	Mean	M_1	M_2	Mean	M_1	M_2	Mean
N_1	2.10	2.10	2.10	3.30	3.50	3.40	3.70	3.80	3.75
N_2	2.20	2.20	2.20	3.90	4.10	4.00	4.80	5.00	4.90
N_3	2.20	2.30	2.25	4.50	4.80	4.65	5.10	5.30	5.20
N_4	2.30	2.30	2.30	5.20	5.40	5.30	5.60	5.90	5.75
Mean	2.20	2.23		4.23	4.45		4.80	5.00	
	M	N	M x N	N x M	M	N	M x N	N x M	M	N	M x N	N x M
SEd	0.05	0.08	0.13	0.11	0.14	0.16	0.30	0.23	0.16	0.22	0.37	0.30
CD (p=0.05)	NS	NS	NS	NS	NS	0.36	NS	NS	NS	0.47	NS	NS

Main plot: Date of sowing; M1: Sowing next day after rice harvest, M2: Sowing 15 days after rice harvest
Sub plot: Nutrient management; N_1 : 0% RDF, N_2 : 50% RDF, N_3 : 75% RDF, N_4 : 100% RDF

Yield attributes

The result on yield attributes is presented in table 3 and figure 1. One hundred grain weight was not significantly influenced by any date of sowing after the rice harvest or graded doses of fertilizers and interaction between date of sowing after the rice harvest and graded doses of fertilizers. Different dates of sowing after the rice harvest and interaction between date of sowing after the rice harvest and graded doses of fertilizers did not significantly influence on clusters plant^{-1}, pods plant^{-1} and seeds pod^{-1}.

Table 3: Effect of different dates of sowing and nutrient management practices on yield attributes of rice fallow blackgram 2019

Treatment	Clusters plant[-1]			Pods plant[-1]			Seeds pod[-1]			100 seed weight		
	M_1	M_2	Mean	M_1	M_2	Mean	M_1	M_2	Mean	M_1	M_2	Mean
N_1	6.50	6.90	6.70	29.80	30.90	30.35	4.20	4.50	4.35	4.20	4.20	4.20
N_2	8.10	8.50	8.30	34.00	34.20	34.10	5.60	5.80	5.70	4.40	4.40	4.40
N_3	9.50	9.80	9.65	36.40	36.80	36.60	6.00	6.20	6.10	4.50	4.50	4.50
N_4	10.10	10.20	10.15	38.20	38.50	38.35	6.70	6.90	6.80	4.50	4.50	4.50
Mean	8.55	8.85		34.60	35.10		5.63	5.85		4.40	4.40	
	M	N	M x N	N x M	M	N	M x N	N x M	M	N	M x N	N x M	M	N	M x N	N x M
SEd	0.20	0.31	0.53	0.44	0.66	1.61	2.55	2.28	0.17	0.18	0.34	0.25	0.07	0.15	0.25	0.22
CD (p=0.05)	NS	0.67	NS	NS	NS	3.51	NS	NS	NS	0.39	NS	NS	NS	NS	NS	NS

Main plot: Date of sowing; M1: Sowing next day after rice harvest, M2: Sowing 15 days after rice harvest
Sub plot: Nutrient management; N_1 : 0% RDF, N_2 : 50% RDF, N_3 : 75% RDF, N_4 : 100% RDF
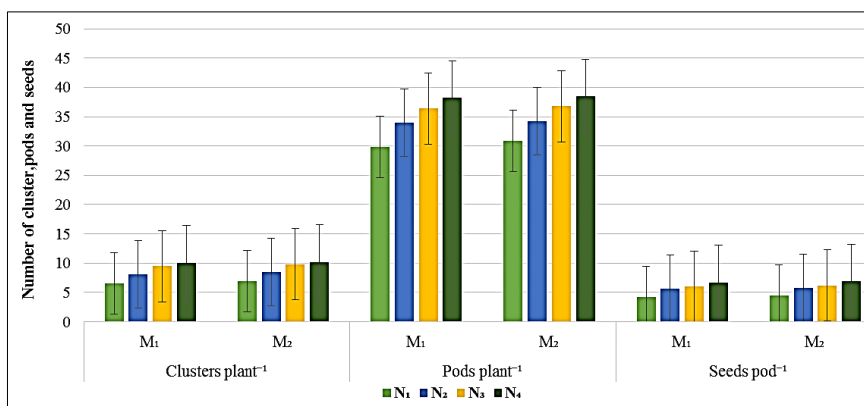

Fig 1: Effect of different dates of sowing and nutrient management practices on yield attributes of rice fallow blackgram 2019

Graded doses of fertilizers significantly influenced the clusters plant[-1], pods plant[-1] and seeds pod[-1].Maximum number of clusters plant[-1], pods plant[-1] and seeds pod[-1] was noted in 100% RDF (N_4), which was on par with 75% RDF (N_3). Lesser number of clusters plant[-1], pods plant[-1] and seeds pod[-1] was recorded in 0% RDF (N_1). The highest yield attributes gained under these treatments might be due to higher doses of fertilizer, which might have provided favourable soil environment and nourishment for better plant growth that resulted in better vegetative growth in terms of plant height and in increased yield attributes. Positive response in terms of yield attributes to nutrient management have also been reported by Quddus *et al.,* (2012) [7], Amruta *et al.,* (2015) [1], Meena *et al.,* (2016) [6] and Mainul *et al.* (2016) [5].

Yield
The data on grain and haulm yield are presented in table 4 and figure 2. Grain and haulm yield of blackgram was not significantly influenced by different dates of sowing after the rice harvest. Interaction between dates of sowing after rice harvest and fertilizer levels has no notable difference in grain and haulm yield of blackgram.

The level of different nutrients significantly influenced the grain and haulm yield. The higher grain and haulm yield was noted in 100% RDF (N_4), which was on par with 75% RDF (N_3). Lesser grain and haulm yield was recorded in 0% RDF (N_1). This may be attributed to availability of sufficient amount of nutrients throughout growth period resulting in superior yield. The highest grain and haulm yield in this treatment was mainly due to the fact that under favourable soil conditions, the plant accumulates and translocates of photosynthates from source to the sink more efficiently which inturn increased all the growth and yield attributes too, which ultimately paved a way to higher yield. Similar results were also reported by Jadhav *et al.,* (2008) [2, 4].

Table 4: Effect of different dates of sowing and nutrient management practices on grain yield (kg ha^{-1}) and haulm yield (kg ha^{-1}) of summer blackgram 2019

Treatment	Grain yield (kg ha^{-1})			Haulm yield (kg ha^{-1})		
	M_1	M_2	Mean	M_1	M_2	Mean
N_1	602.0	608.0	605.0	1198.0	1245.0	1221.5
N_2	769.0	785.0	777.0	1497.0	1512.0	1504.5
N_3	801.0	812.0	806.5	1636.0	1631.0	1633.5
N_4	871.0	895.0	883.0	1673.0	1763.0	1718.0
Mean	760.8	775.0		1501.0	1537.8	
	M	N	M x N	N x M	M	N	M x N	N x M
SEd	15.65	25.64	42.98	36.27	37.75	73.18	119.11	103.49
CD (p=0.05)	NS	55.87	NS	NS	NS	159.45	NS	NS

Main plot: Date of sowing; M1: Sowing next day after rice harvest, M2: Sowing 15 days after rice harvest
Sub plot: Nutrient management; N_1 : 0% RDF, N_2 : 50% RDF, N_3 : 75% RDF, N_4 : 100% RDF
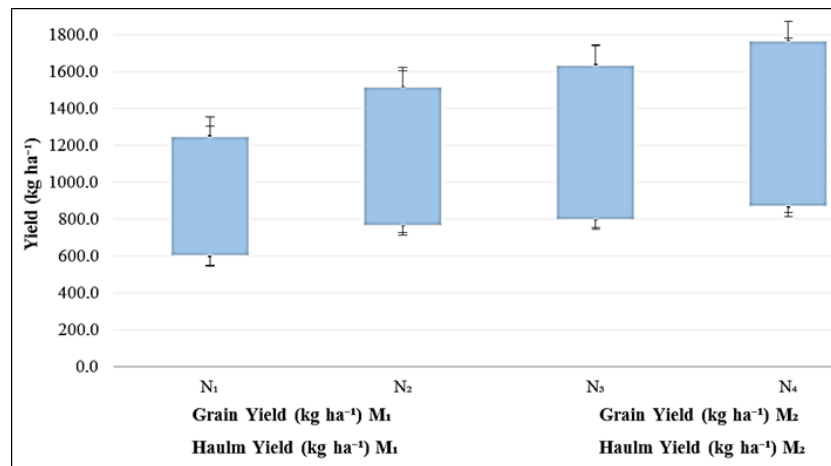
Fig 2: Effect of different dates of sowing and nutrient management practices on grain yield (kg ha^{-1}) and haulm yield (kg ha^{-1}) of summer blackgram 2019

Conclusion
From the results narrated above, it can be concluded that application of 75% RDF, which was on par with 100% RDF is an efficient and advisable treatment for increasing production with higher grain yield along with high monetary returns in rice fallow blackgram. Nutrient management must be sound for achieving production target on sustainable basis. Thus, urdbean can be successfully grown under rice fallow condition, 75% RDF is best optimum dose for maximum productivity and profitability.

Acknowledgement

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