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Studies on foliar nutrient application on productivity and uptake of *rabi* blackgram

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Abstract
A field experiment carried out at Agricultural Research Station, Brinjhagiri, Chatabar of Faculty of Agricultural Sciences, Siksha 'O' Anusandaha (Deemed to be University), Bhubbaneswar, Odisha during *rabi* season of 2018 and 2019. The experiment was laid out in randomised block design with eight treatments viz. T_1: Control, T_2: RDF (20: 40: 20 kg N, P_2O_5 and K_2O ha^{-1}), T_3: RDF + 2% Urea spray; T_4: RDF + 2% MOP spray; T_5: RDF + 2% DAP spray, T_6: RDF + 2% NPK 19:19:19 spray; T_7: RDF + 40 ppm NAA spray; T_8: RDF + 1% Salicylic spray, replicated 3 times. The test variety was Mahuri (OBG 31). The result revelled that foliar application of urea, DAP, MOP, NPK 19:19: 19, NAA and salicylic acid have positive increment over sole RDF. With 2% spray of NPK 19:19: 19 in addition to RDF (20: 40: 20 kg N, P_2O_5 and K_2O ha^{-1}) higher growth attributes were recorded. This treatment also produced the highest yield of 988.4 kg and 1053.3 kg per ha in 2018 and 2019 respectively. The highest NPK uptake was also calculated in the same treatment for both the years. Economically 2% foliar application of DAP along with RDF (20 kg N, 40 kg P_2O_5 and 20 kg K_2O kg ha^{-1}) found to be the best, with a return of Rs 1.85 and Rs 2.02 by investing a rupee for the respective year.

Keywords: blackgram, foliar nutrient management, productivity, nutrient uptake

Introduction
Pulses are rich sources of protein and strength, but in India, these are largely cultivated beneath power-starved environments, wholly on marginal and sub-marginal land. Pulses are basic part of many diets across the country and are considered to have great potential for human health. More than three-fourth of the area below pulses remains to
be rainfed resulting in low crop productivity (Choudhary 2013) [2]. Being grouped under legumes play an important role in soil conservation, environment safety and also contribute to food security (Singh *et al*. 2009) [11].
Blackgram (*Vigna mungo* L.) is one of the most important pulse crop of rainfed areas grown across the country. One of being the most diversified crop of India it fits well in different cropping system as a mixed crop, catch crop & sequential crops. This crop is grown in different cropping system as a mixed crop, catch crop, sequential crop in the country. Blackgram seed contains 25-26% proteins, 60% carbohydrates, 1.5% fat, and minerals combination, amino acid, and essential vitamins etc. In India blackgram is very popularly grown in Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, U.P., Odisha West Bengal, Punjab, Haryana, and Karnataka (Kumar 2015) [7].
Pulses gone through different types of contains thus the productivity of pulses low in India in compare to other countries. Genetic greasepaint and different physiological factor viz., insufficient portioning assimilates, poor pod setting due to the flower abscission and lack of nutrients during critical stage of crop growth, coupled with a number of disease and pest (Mahala *et al.*, 2001) [9] constitute the major constraints for the poor yield. The other facts of miserable situation regarding the low position in respect of yield levels is accredited to input use efficiency, degradation of resources like soil and water and slowing of total system productivity. Henceforth, there is need for enhancement of the productivity of blackgram by adopting suitable agronomic practices is necessary. Among them, one is foliar application of nutrients for increasing the potentiality of the crop. This is considered an efficient and economic method of supplementing part of nutrients requirements at critical stages. Foliar nutrients usually penetrate the leaf cuticle or stomata and enters the cells facilitating easy and rapid utilization of nutrients. Foliar application of N at particular stage may solve the slow growth, nodule senescence and low seed yield of pulse without involving root absorption at

critical stage (Latha and Nadanassababady, 2003) [8]. Application of nutrients through foliar spray at appropriate stages of growth becomes important for their utilization and better performance of the crop (Anandhakrishnaveni *et al*., 2004) [1]. Considering the above facts, objectives of this study was planned and carried out during *rabi* season 2018 and 2019 respectively.

Materials and Methods

The present experiment was laid out at Agricultural Research Station, Brinjhagiri, Chatabar of Faculty of Agricultural Sciences, Siksha 'O' Anusandaha (Deemed to be University), Bhubaneswar, Odisha during *rabi* season of 2018 and 2019. The site is situated in Khordha district of Odisha at the latitude of 20^0 North and longitude of 85^0 East at a latitude of 58 m above mean sea level. The soil of the experimental field was fine in texture with a neutral pH (6.5), low in available N (201.3 kg ha^{-1}), medium in available phosphorous (19.72 kg ha^{-1}) and low available potassium (119.7 kg ha^{-1}). The experiment was laid out in a randomized block design with eight treatments and was replicated three times. The treatments T_1: Control, T_2: RDF (20: 40: 20 kg N, P_2O_5 and K_2O ha^{-1}), T_3: RDF + 2% Urea spray; T_4: RDF + 2% MOP spray; T_5: RDF + 2% DAP spray, T_6: RDF + 2% NPK 19:19:19 spray; T_7: RDF + 40 ppm spray; T_8: RDF + 1% Salicylic spray. The test variety was Mahuri (OBG 31). The observation on growth parameters (plant height and dry matter accumulation) were taken at harvesting. Similarly, the yield attributes (no of pods per plant, no of seeds per pod) and yield (seed and stover yield) were taken during the harvesting. Nitrogen, phosphorus and potassium content (%) and uptake (kg ha^{-1}) were evaluated in laboratory after the harvest of crop. The total nitrogen content in plant was determined by modified Kjeldahl method (Jackson, 1973) [6]. Total phosphorus content of the plant materials wasdetermined by Vanadomolybdo-phosphoric acid yellow color method in HNO_3 system with the help of UV-Vis Spectrophotometer. Potassium content of the plant material was determined by wet digestion method with the help of Flame photometer (Jackson, 1973) [6]. The results pertaining to analysis of plant samples, yield and uptake values were subjected to analysis of variance and correlation statistics as suggested by Gomez and Gomez (1984) [5].

Results and Discussion

Growth parameters: Growth parameters viz. Plant height, no of branches, LAI and dry matter production were observed. The result revealed that significant changes due to foliar application of nutrients over RDF and control in both the years (Table 1). The tallest plant were found (51.50 cm and 55.10 cm for 2018 and 2019 respectively) in the treatment T_6 which is significantly best among all treatments. The next taller plants (49.8 cm and 52.1 cm for 2018 and 2019 respectively) were measured in the treatment T_7 and the treatment receives RDF + 2% DAP (T_5) spray shows the third taller (48.2 cm and 51.90 cm respectively for 2018 and 2019) plants. The maximum no of branches of 5.63 and 5.97 respectively was counted in the treatment T_6 and in treatment T_7 next higher (5.51 and 5.72) total branches/plant were found. The leaf area index, shows the highest value (3.12 and 3.16 respectively) in the treatment T_6 and it was closely followed by the LAI (3.07 and 3.10) calculated in T_7. The highest dry weight of 693.60 g m^{-2} and 725.23 g m^{-2} are found for the year 2018 and 2019 respectively in the treatment T_6 and the treatment receives RDF+ 400 ppm NAA (T_7) spray produced the 2nd highest dry weight of 644.52 g m^{-2} in 2018 693.77 g m^{-2} in 2019. The lowest values of plant height, branches/plant, LAI and dry matter is recorded in treatment T_1 i.e control. The foliar application of 1% salicylic acid in addition to RDF have a negligible increment over RDF in all growth parameters.

Foliar application of nutrients definitely influenced plant's phonological characters such as plant height, branch no, LAI etc, which makes these characters significantly superior in compare to the same under the treatment control. Nitrogen has been widely accepted as dominant growth promoter. The significant increase of plant height, branch no and LAI was due to the internode's elongation, formation of more lateral branches and the dynamic root growth. Significant increase in plant height with foliar application can be attributed to the fact that micronutrients enhance plant vigour and strengthen the stalk (Das, 1999)[3]. The increase in branches per plant due to the foliar application of NPK 19:19: 19, DAP, urea in various treatments definitely helped in acceleration of several metabolic process viz. photosynthesis, energy transfer reaction and symbiotic biological N- fixation process. More number of branches and plant height might be due to the more availability of auxin, nitrogen and phosphorus, which plays a vital role in cell division. Characters like stem, branches, leaves, pods and grains inside the pods directly influences the dry matter production. The significant increase of dry weight/plant was because nitrogen helps in sustaining higher auxin level, which might have resulted in better plant height and leaf area. This might have brought about into the better interception, absorption and utilization of radial energy, leading to higher photosynthetic rate and finally more accumulation of dry matter by the plants Geetha and Velayutham (2009) [4].

Nodule no per plant shows a significant increase in the treatments receive foliar application of either NPK, DAP, Urea or NAA in addition to RDF. Due to this variation, the dry weight of nodules also varies. The highest no. of nodules (16.87 and 22.77 respectively for 2018 and 2019) are found in the treatment T_6 in both the years. The nodule no per plant under RDF is 14.50 and 17.60 for the year 2018 and 2019 respectively, whereas, the least are counted in control treatment (11.03 and 13.53 for 2018 and 2019 respectively). Likewise the nodule no per plant its dry weight followed the same trend. The highest dry weight of 10.84 mg in 2018 and 11.17 mg in 2019 in the treatment receives RDF + 2% spray of NPK 19:19:19 twice (T_6).

Yield attributes and yield: The yield attributes like pods per plant, seeds per pod and test weight shows significant variations due to different nutrient management practices. There is no significant variation found in case of test weight of blackgram for both the years, although foliar application have slight increment over RDF and control (Table 2). The highest no of pods per plant (42.67 and 47.42 in 2018 and 2019) was counted in the treatment which received RDF and foliar spray of 2% NPK 19:19:19, this treatment has a slight advantage over the treatment where 40 ppm NAA was sprayed in addition to RDF. Maximum no of seeds in pods (5.11 in 2018 and 5.39 in 2019) are seen in T_6 which is followed by T_7, with a value are 4.93 and 5.09 respectively. In the treatment T_2 (RDF) 4.19 and 4.51 no of seeds per pods were counted in consecutive two years. The highest test weight (45.68 g and 46.97 g respectively for 2018 and 2019)

are recorded in T_6. Whereas, in RDF, the values are 42.37 g & 43.03 g respectively for 2018 2019, whereas, the lowest are 40.11 g and 40.58 g respectively are recorded in control for the same years.

The seed yield shows a significant improvement in the treatments receives a foliar spray over sole RDF. The highest seed yield (989.4 kg/ha in 2018 and 1053.33 kg/ha in 2019 respectively) is recorded in T_6 (RDF + 2% spray of NPK 19:19:19). The treatment T_7 follows next with seed yield of 953.7 kg/ha 994.00 kg/ha respectively. In sole RDF treatment seed yield are 646.7 kg/ha and 689.67 kg/ha respectively for 2018 and 2019, whereas the lowest seed yield of 400.2 kg/ha and 439.20 kg/ha are found in absolute control. The increased in yield might be due to enhanced yield attributes like number of pods plant^{-1}, number of seeds pod$^{-1.}$ It is due to increased uptake of nutrients by blackgram by effective translocation of nutrients from sink to reproductive area of crop. These findings are in agreement with Subramani and Solaimalai (2000) [13] and Sundari and Sureshkumar (2004) [14].

Nutrient uptake: Nutrient uptake by seed and stover showed a significant variations due to foliar nutrient application. The highest N, P and K uptake by seed is observed in the treatment T_6 which receives RDF + 2% spray of NPK 19:19:19 twice in both the years (table 4). Here the uptake values in the first year and second year respectively are 36.56 and 40.46 kg ha^{-1} N, 3.28 and 3.64 kg ha^{-1} P and 19.87 and 22.40 kg ha^{-1}K in seeds. Whereas, in stover these uptake values are 64.29 and 71.92 kg ha^{-1} N, 2.83 and 3.18 kg ha^{-1} P and 33.36 and 35.65 kg ha^{-1} K are accumulated for 2018 and 2019 respectively. Now, theses increased uptake may be due to that, foliar application is credited with the advantage of quick and efficient utilization of nutrients, elimination of losses through leaching and fixation and regulating the uptake of nutrient by plants Manonmani and Srimathi (2009) [10].

Economics: Foliar application of either urea, MOP, DAP, NAA or NPK 19:19:19 in addition to RDF fetches more profit than sole RDF as well as control in both the year (Table 2). The market price of such chemicals ultimately decides the profit range. The foliar application of NPK 19:19:19 produced the highest seed yield in both the years but higher price kept it 2nd best treatment behind foliar DAP application. Under treatment T_5 the highest return per rupee investment was calculated with a value of 1.85 and 2.02 respectively for 2018 and 2019, however in the treatment T6 it is 1.84 and 1.85 respectively for 2018 and 2019.in both the years the return per rupee invested was calculated 1.36 in the treatment sole RDF and in control it is mare 1.0.

Table 1: Effect of foliar nutrient application on practices on growth parameters of *rabi* blackgram

Treatments	Plant height (cm)		No for branches per plant		LAI		Dry matter production (g m^2)	
	2018	2019	2018	2019	2018	2019	2018	2019
T_1: Control	31.6	32.70	3.92	4.08	2.38	2.47	273.58	286.88
T_2: RDF (20: 40: 20 kg N, P_2O_5 and K_2O ha^{-1})	39.9	42.00	5.11	5.15	2.88	2.92	369.49	381.15
T_3: RDF + 2% spray of Urea	47.5	50.70	5.08	5.28	3.00	3.04	600.62	620.51
T_4: RDF + 2% Spray of MOP	46.8	50.10	5.14	5.21	2.96	3.01	587.61	605.04
T_5: RDF + 2% spray of DAP	48.2	51.90	5.25	5.32	3.03	3.06	598.73	637.75
T_6: RDF + 2% spray of NPK 19:19:19	51.5	55.10	5.63	5.97	3.12	3.16	693.60	725.23
T_7: RDF + 40 ppm spray of NAA	49.8	52.10	5.51	5.72	3.07	3.10	644.52	693.77
T_8: RDF + 1% Salicylic acid	43.7	47.80	5.05	5.18	2.91	2.99	401.37	435.27
SEm±	0.49	0.53	0.035	0.094	0.092	0.097	16.39	20.89
CD (P=0.05)	1.38	1.5	0.11	0.26	0.21	0.27	46.08	58.70

Table 2: Effect of foliar nutrient application on yield attributes, yield and economics of *rabi* blackgram

Treatments	Pods/ Plants		Seeds/pod		Test weight (g)		Seed yield (kg/ha)		Return per rupee invested	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
T_1: Control	17.04	18.13	3.21	3.84	40.11	40.58	400.2	439.20	1.00	1.00
T_2: RDF (20: 40: 20 kg N, P_2O_5 and K_2O ha^{-1})	24.60	27.30	4.19	4.51	42.37	43.03	646.7	689.67	1.36	1.36
T_3: RDF + 2% spray of Urea	29.56	33.37	4.75	4.90	45.17	45.53	900.3	946.67	1.81	1.82
T_4: RDF + 2% Spray of MOP	26.94	31.57	4.67	4.62	45.11	43.35	868.5	896.00	1.71	1.77
T_5: RDF + 2% spray of DAP	26.21	30.37	4.32	4.95	45.0	46.33	892.6	918.00	1.85	2.02
T_6: RDF + 2% spray of NPK 19:19:19	42.67	47.42	5.11	5.39	45.68	46.97	989.4	1053.33	1.84	1.85
T_7: RDF + 40 ppm spray of NAA	35.48	42.37	4.93	5.09	45.23	46.67	933.7	994.00	1.83	1.83
T_8: RDF + 1% Salicylic acid	25.84	28.23	4.25	4.54	42.80	43.29	733.3	759.33	1.37	1.37
SEm±	2.77	1.81	0.17	0.18	2.81	3.7	27.68	32.15	-	-
CD (P=0.05)	7.2	5.05	0.47	0.50	NS	NS	77.80	90.02	-	-

Table 3: Effect of foliar nutrient application on number of nodules/plant and Dry weight of nodules/plant (mg)

Treatments	No of nodules/plant		Nodule dry weight/plant (mg)	
	2018	2019	2018	2019
Control	11.03	13.53	3.84	4.34
RDF (20: 40: 20 kg N, P_2O_5 and K_2O ha^{-1})	14.50	17.60	7.88	9.30
RDF + 2% spray of Urea	15.47	19.07	8.02	9.73
RDF + 2% Spray of MOP	15.33	18.88	8.34	9.57
RDF + 2% spray of DAP	15.20	18.63	8.98	9.39
RDF + 2% spray of NPK 19:19:19	16.87	22.77	10.84	11.17
RDF + 40 ppm spray of NAA	16.20	20.80	9.51	10.91
RDF + 1% Salicylic acid	15.12	18.00	8.00	9.37
SEm±	0.28	0.61	0.144	0.378
CD (P=0.05)	0.78	1.70	0.401	1.05

Table 4: Effect of foliar nutrient application on Nutrient uptake by seed and Stover of *rabi* blackgram

Treatments	Uptake by Grain (kg ha^{-1})						Uptake by Grain (kg ha^{-1})					
	N	P	K	N	P	K	N	P	K	N	P	K
		2018		2019			2018				2019	
T_1	12.01	0.87	5.76	14.77	0.98	6.53	21.89	0.95	11.63	24.30	1.09	12.44
T_2	21.15	1.60	10.35	25.50	1.70	11.50	39.47	1.63	19.34	42.29	1.85	20.36
T_3	31.99	2.48	15.67	35.54	2.84	16.80	53.63	2.25	25.81	56.73	2.50	27.14
T_4	29.96	2.28	14.59	33.25	2.48	15.50	51.17	2.12	24.56	53.45	2.33	25.64
T_5	32.40	2.47	15.80	33.77	2.54	15.76	50.25	2.23	24.59	54.94	2.51	26.64
T_6	37.56	3.28	19.87	40.46	3.64	22.40	64.29	2.83	33.36	71.92	3.18	35.65
T_7	35.48	3.01	18.60	37.76	3.28	20.16	59.57	2.66	31.68	64.09	2.86	32.72
T_8	24.64	1.88	11.88	27.80	1.97	12.63	43.68	1.84	21.58	45.30	1.99	21.94
S. Em±	0.81	0.11	0.47	1.34	0.15	0.898	1.81	0.07	0.62	3.28	0.16	1.54
CD(P=0.05)	2.26	0.31	1.32	3.76	0.42	2.51	5.08	0.21	1.72	9.18	0.45	4.31

T_1: Control, T_2: RDF (20: 40: 20 kg N, P_2O_5 and K_2O ha^{-1}), T_3: RDF + 2% Urea spray; T_4: RDF + 2% MOP spray; T_5: RDF + 2% DAP spray, T_6: RDF + 2% NPK 19:19:19 spray; T_7: RDF + 40 ppm spray; T_8: RDF + 1% Salicylic spray

Conclusion

Application of 2% foliar NPK 19:19:19 twice along with RDF (20 kg N, 40 kg P_2O_5 and 20 kg K_2O kg ha^{-1}) found to be the best among all foliar nutrient application in terms of growth and yield of *rabi* Blackgram. The application of such combination RDF (20 kg N, 40 kg P_2O_5 and 20 kg K_2O kg ha^{-1}) + 2% NAA 19:19:19 helps in higher uptake. On economic return due to higher market price of NPK 19:19:19 though the highest seed yield was measured with T_6 but here the treatment T_5 i.e 2% foliar application of DAP along with RDF (20 kg N, 40 kg P_2O_5 and 20 kg K_2O kg ha^{-1}) found to be the best.

References

1. Anandhakrishnaveni Mahala CPS, Dadheech RC, Kulhari RK. Effect of plant growth regulators and yield of Black gram at varying levels of phosphorus. Crop Research 2001;18(1):163-165.
2. Choudhary AK, Raje RS, Datta S, Sultana R, Ontagodi T. Conventional and molecular approaches towards genetic improvement in pigeon pea for insects resistance. American J of Plant Sciences, 2013, 372-385.
3. Das PC. Plants Nutrients. In: Manures and Fertilizers. 2nd Edition 1999.
   Kalyani Publishers, New Dehli, India, 5-10.
4. Geetha P, Velayutham A. Refinement of nutrient management techniques for growth, yield and nutrient uptake of rice fallow blackgram. Madras Agricultural Journal 2009;96(1-6):163-166.
5. Gomez KA, Gomez AA. Statistical procedure for agriculture research, 2nd Edn. International Rice Research Institute, Los Banos, Philipines. John Wily and Sons, New York, 1984, 324.
6. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd. New York, 1973, 61.
7. Kumar RC, Deka B, Ngachan SV. Response of summer mungbean to sowing time, seed rates and integrated nutrient management. Agricultural Research Communication Centre 2015;38(3):348-352.
8. Latha MR, Nadanassababady T. Foliar nutrition in crops. Agricultural Review 2003;24(3):229-234.
9. Mahala CPS, Dadheech RC, Kulhari RK. Effect of plant growth regulators and yield of Black gram at varying levels of phosphorus. Crop Research 2001;18(1):163-165.
10. Manonmani V, Srimathi P. Influence of mother crop nutrition on seed and quality of balckgram. Madras Agriculture Journal 2009;96(16):125-128.
11. Singh KK, Ali M, Venkatesh MS. Pulses in Cropping Systems. Technical Bulletin, IIPR, Kanpur, 2009, 34.
12. Srinivasan K, Ramasamy M. Effect of foliar application of urea and DAP on rainfed cowpea (*Vigna ungiculata*). Indian Journal of Agronomy 1992;37(2):265-267.
13. Subramani M, Solaimalai A. Influence of plant populations and methods of nutrient application on growth and yield of blackgram. Legume Research 2000;23(3):197-198.
14. Sundari A, Sureshkumar SM. Influence of D A P and rhizobacteria on growth and yield of blackgram under rice-fallow condition. J of Ecobiology 2004;16(1):75-77.