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Studies on Blackgram Performance under Varied Cropping Systems

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ABSTRACT

Urdbean/blackgram (*Vigna mungo* (L.) Hepper) is an important pulse crop grown throughout India. In South India particularly in Andhra Pradesh and Tamil Nadu blackgram has been grown for decades, as a rice-fallow crop without any agronomic management. However, having realized the highest net returns, scientists bestowed their attention in improving the conditions for better establishment and higher productivity of blackgram. Crop rotations under which the blackgram crop is grown is said to have significant influence on the soil physico-chemical makeup and fertility status there by influencing the growth and yield of blackgram. In Pamidimukkala mandal blackgram is grown in *rabi* as rice-fallow crop year after year, while in some parts of the area, particularly in high lands with good drainage, this cropping sequence is rotated after every 2-3 years with sugarcane. The blackgram crop under sugarcane rotated cropping sequence is said to perform better than the repeated rice-blackgram sequence. So, it is proposed to study the impact of previous crops *i.e.* rice and sugarcane on the performance of blackgram.

Key words : Cropping systems, Correlation, Urdbean.

The productivity of the soils largely depends on physico-chemical makeup of the soils and also the management practices adopted by the farmers in the given area. Besides changing cropping pattern is said to have much positive impact on soil properties and also negative impact on pest, disease and weed population thereby minimizes the input costs in agriculture. In view of this it is imperative to measure the change in soil characteristics under varied cropping systems and test its impact on Blackgram crop which is commonly cultivated as rice fallow crop in deltaic region.

MATERIAL AND METHODS

The study area in Pamidimukkala mandal was categorized into two groups based on the cropping systems being practiced over decades. The soils were heavy with mostly clayey texture. In one category, rice-pulse (rice fallow pulse) cropping system is followed year after year, whereas in the other category the same cropping system is rotated with sugarcane after every 2-3 years. The varieties under cultivation were CO-7219 and CO-7805 of sugarcane, Vijeta and Sambamasuri of rice and LBG-645 and LBG-648 of blackgram, where soil and plant samples were collected and analysed. Forty soil samples, twenty under each category, were collected in the summer when fields were fallow and again at the flowering stage of blackgram and were analysed for nutrient status. Plant samples of blackgram were collected in *rabi*, at harvest and were analysed to calculate the nutrient content and uptake. Blackgram yield data was also collected from the representative fields to study the influence of cropping systems on its performance. Correlation coefficients were calculated between soil nutrient status and grain yield of blackgram (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

The available N, P_2O_5, K_2O and S in the rice-blackgram fields ranged from 193 to 321, 15 to 58, 258 to 578 kg ha^{-1} and 16 to 86 ppm respectively (Table 1a). These nutrients in the sugarcane rotated fields ranged from 208 to 351, 27 to 72, 276 to 652 kg ha^{-1} and 19 to 103 ppm respectively (Table 1b). The overall available nitrogen was found to increase from a mean value of 267.08 to 285.03 kg ha^{-1} which might be ascribed to the residual fertility due to fertilizers applied to the preceding paddy crop. Similar results were earlier reported by Dubey and Verma (1999) and

Table 1a. Nutrient status of soils in summer and at flowering stage of blackgram (rabi) in continuous rice-blackgram sequence.

S.No.	Initial soil (summer)				At flowering stage of blackgram			
	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})	Available S (ppm)	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})	Available S (ppm)
1.	286	32	578	33	315	39	636	42
2.	236	15	377	54	262	20	404	63
3.	295	39	394	23	327	45	433	32
4.	321	42	386	28	299	48	425	33
5.	193	47	415	25	218	55	454	37
6.	281	38	381	34	307	43	407	39
7.	264	52	374	26	238	57	418	28
8.	302	56	389	67	331	61	439	73
9.	240	28	424	31	232	33	474	42
10.	259	36	341	20	236	41	389	33
11.	281	27	414	16	315	32	468	25
12.	243	54	384	55	222	55	337	66
13.	241	50	355	86	268	53	394	99
14.	256	58	415	27	283	63	485	36
15.	235	20	274	30	267	25	306	45
16.	221	53	327.	24	244	57	387	34
17.	208	39	381	18	232	43	446	26
18.	281	34	258	47	308	41	292	28
19.	234	28	278	48	261	59	462	52
20.	306	55	398	69	364	59	453	82

Table 1b : Nutrient status of soils in summer and at flowering stage of blackgram (rabi) in rice-blackgram sequence with sugarcane rotation

S.No.	Initial soil (summer)				At flowering stage of blackgram			
	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})	Available S (ppm)	Available N (kg ha^{-1})	Available P_2O_5 (kg ha^{-1})	Available K_2O (kg ha^{-1})	Available S (ppm)
1.	281	42	276	49	311	49	469	57
2.	299	54	349	26	328	58	399	37
3.	266	41	358	22	252	48	407	35
4.	272	72	358	19	257	82	413	33
5.	265	57	371	24	285	66	421	38
6.	279	68	388	28	306	74	448	35
7.	298	47	289	30	317	53	375	39
8.	208	48	296	21	231	56	382	34
9.	249	43	309	36	264	48	379	45
10.	264	46	362	27	252	53	437	38
11.	285	54	652	37	318	59	734	46
12.	278	43	299	98	296	48	348	113
13.	287	38	358	33	324	46	407	47
14.	259	36	289	21	278	44	473	35
15.	284	44	446	38	262	52	506	46
16.	270	57	374	23	298	65	434	36
17.	289	42	453	21	319	48	521	31
18.	351	46	345	103	423	56	405	128
19.	278	27	352	52	304	37	414	66
20.	238	41	318	28	265	47	388	37

Table 2a. Nutrient content and uptake, blackgram grain yield at harvest in non-sugarcane paddy-blackgram fields.

S.No.	Nutrient content (%)			Nutrient uptake (kg ha^{-1})			Grainyield (Kg ha^{-1})
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium	
1.	3.31	0.48	0.82	39.72	5.76	9.84	1200
2.	3.39	0.46	0.97	33.60	4.60	9.70	1000
3.	3.36	0.43	0.88	28.56	3.65	7.48	850
4.	3.25	0.47	0.86	39.81	5.75	10.54	1225
5.	3.28	0.48	0.80	41.00	6.06	10.00	1250
6.	3.33	0.42	0.94	27.03	3.41	7.63	812
7.	3.37	0.47	1.00	30.24	4.23	9.30	900
8.	3.35	0.43	0.82	35.17	4.51	8.61	1050
9.	3.22	0.48	0.78	35.42	5.28	8.58	1100
10.	3.42	0.45	0.93	33.50	4.50	9.30	1000
11.	3.34	0.47	0.98	35.07	4.93	10.29	1050
12.	3.30	0.50	0.58	28.05	4.25	7.23	850
13.	3.21	0.45	0.76	38.52	5.40	9.12	1200
14.	3.32	0.48	0.91	38.06	5.52	10.47	1150
15.	3.27	0.47	0.79	36.36	5.22	8.78	890
16.	3.36	0.46	1.01	38.75	5.29	11.62	1150
17.	3.35	0.48	1.02	26.81	3.84	8.16	800
18.	3.28	0.43	0.80	27.06	3.54	6.60	825
19.	3.30	0.46	0.87	29.70	4.14	7.83	900
20.	3.32	0.44	0.97	33.00	4.40	9.70	1000

Sreenivasa Raju *et al.* (2003). The overall available phosphorus in soils was found to increase from a mean value of 43.73 during summer to 50.45 kg P_2O_5 ha^{-1} at the time of blackgram flowering stage. These results were in accordance with the findings reported by Goswami *et al.* (1996) and Masthan *et al.* (1999). The available potassium content of soils also increased from a mean value of 369.6 to 431.73 kg K_2O ha^{-1}, which was in concurrence with the results reported by Sharma and Mittra (1991) and Singh *et al.* (1999).

Nitrogen, phosphorus and potassium contents of blackgram grain at harvest ranged between 3.21 to 3.42%, 0.42 to 0.50% and 0.58 to 1.02% , respectively under non-sugarcane paddy-pulse fields (Table 2a). These nutrient contents ranged between 3.25 to 3.42% , 0.42 to 0.52% and 0.79 to 1.06% , respectively in sugarcane rotated paddy-pulse fields (Table 2b). Nitrogen, phosphorus and potassium uptake by grain under non-sugarcane fields ranged from 26.81 to 41.00, 3.41 to 6.06 and 6.60 to 11.62 kg ha^{-1}, respectively. The grain uptakes under sugarcane rotated fields ranged from 34.20 to 61.42, 4.40 to 8.69 and 10.00 to 17.42 kg ha^{-1}, respectively. Grain yield of blackgram was high under sugarcane rotated paddy-pulse fields, ranging between 1000 and 1850 kg ha^{-1} (Table 2b), than under non-sugarcane fields which ranged from 800 to 1250 kg ha^{-1} (Table 2a). The above mentioned observations were in accordance with the findings reported by Verma and Sharma (1994), Rawat *et al.* (1996), Singh *et al.* (2001) and Sreenivasa Raju *et al.* (2003).

Soil available nitrogen content was found to have positive correlation with nitrogen uptake (r=0.049) and grain yield of blackgram (r = 0.0456). Available phosphorus has shown positive correlation with phosphorus uptake (r = 0.3039) and also with the grain yield (r = 0.301). Available potassium status of soil was positively correlated with potassium uptake (r = 0.103) and blackgram grain yield (r = 0.003) (Table 3). These findings were in agreement with the results reported by Choudhary and Das (1996) and Dhillon *et al.*(1999).

Table 2b. Nutrient content and uptake, blackgram grain yield at harvest in non-sugarcane rotated paddy-blackgram fields.

S.No.	Nutrient content (%)			Nutrient uptake (kg ha^{-1})			Grainyield (Kg ha^{-1})
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium	
1.	3.36	0.47	0.95	37.80	5.28	10.69	1125
2.	3.28	0.49	0.83	58.22	8.69	14.73	1775
3.	3.38	0.47	1.04	42.25	5.28	13.00	1250
4.	3.29	0.46	0.91	37.83	5.29	10.47	1150
5.	3.25	0.48	0.79	55.25	8.16	13.43	1700
6.	3.40	0.49	1.01	58.65	8.45	17.42	1725
7.	3.34	0.45	0.94	59.28	7.98	16.69	1775
8.	3.39	0.46	1.04	54.24	7.52	16.64	1600
9.	3.38	0.43	0.98	55.77	7.09	16.17	1650
10.	3.31	0.42	0.86	59.58	7.56	15.48	1800
11.	3.42	0.44	1.00	34.20	4.40	10.00	1000
12.	3.25	0.48	0.81	50.53	7.44	12.56	1550
13.	3.35	0.44	0.88	40.20	5.28	10.56	1200
14.	3.42	0.43	0.80	50.44	6.34	11.80	1475
15.	3.36	0.45	0.93	54.60	7.31	15.11	1625
16.	3.41	0.48	0.97	59.67	8.40	16.98	1750
17.	3.27	0.47	0.84	54.77	7.87	14.07	1675
18.	3.38	0.52	1.02	40.56	6.12	12.24	1200
19.	3.39	0.47	1.06	44.07	6.11	13.78	1300
20.	3.32	0.43	0.84	61.42	7.95	16.47	1850

Table 3. Correlation coefficients (at 5% level) between available soil nutrient status and blackgram performance.

Nutrient	Nutrient uptake	Grain yield of blackgram
Available N	0.049	0.046
Available P_2O_5	0.303	0.301
Available K_2O	0.103	0.003

Higher nutrient contents, uptakes by grain and grain yield under sugarcane rotated fields might be due to higher residual fertility resulted from high fertilizer application, addition of high organic residues, good soil physical conditions like aeration, bulk density and soil structure *etc*. In paddy-pulse monocropping sequence, mainly the physical conditions of soils created for successful paddy cultivation over decades of cultivation became unfavourable for the succeeding pulse crop, which was grown as rice-fallow crop for recording higher yields. Hence, it is highly recommended to rotate the paddy-blackgram monocropping sequence with sugarcane to keep the soils physically and nutritionally rich to favor the succeeding blackgram for higher yields and returns.

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