



## STUDIES ON YIELD, YIELD RELATED AND PHYSIOLOGICAL TRAITS UNDER ORGANIC INORGANIC FERTILIZER MANAGEMENT UN BLACKGRAM

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Date of Receipt: 30.5.2018

ABSTRACT

Date of Acceptance: 11.9.2018

The present investigation was carried out with 30 blackgram genotypes to compare the mean performance under organic and inorganic fertilizer managements. The results revealed that the genotypes differed in their performance under both the environments. PU-31 was found to be better performing genotype for yield and water use efficiency traits under both the managements. Although plant growth was good under organic fertilizer management, higher yields could not be recorded. This necessitates the need to develop cultivars suitable for organic fertilizer management and emphasizes the importance of selection in the target environment.

**KEYWORDS:** Yield, water use efficiency, blackgram.

### INTRODUCTION

Black gram (*Vigna mungo* L.) is an important short duration pulse crop widely cultivated in India which is an excellent source of easily digestible good quality protein. Pulse crops are generally cultivated in marginally poor soils, mostly in rainfed conditions which leads to low yield.

Uncontrolled application of chemicals not only affects the environment but also depletes the soil quality. Organic farming in recent years is gaining impetus due to realization of inherent advantages it confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment (Lokanath and Parameshwarappa, 2006). Hence it is imperative to evolve an alternative technology of organic farming that provides reasonable yields while restoring the fertility of soil during transitory period (Britto and Girija, 2006).

Water use efficiency is one of the genetic characters which can contribute to higher productivity under scarce water resources. Moisture stress at flowering and pod filling stages reduces seed yield and harvest index significantly. Under such conditions identification of genotypes with higher water use efficiency and high dry matter is research priority. grain quality. Hence, there is a need to develop varieties which perform well in organic farming conditions with high water use efficiency.

### MATERIAL AND METHODS

The present investigation was carried out among 30 blackgram genotypes during *kharij*, 2017 at dry land farm of Sri Venkateswara Agricultural College, Tirupati as two separate trials that differ only in fertilizer managements using a randomized block design with three replications.

In organic management trial, 20 t ha<sup>-1</sup> of FYM was applied at the time of field preparation and *jeevamrutha* was applied at 15 days interval followed by seed treatment with 3 per cent *panchagavya*. On 25<sup>th</sup> and 35<sup>th</sup> days after sowing 3 per cent *panchagavya* was sprayed. For control of sucking pests *bramhasthrum* was sprayed. No inorganic chemicals were used.

Under inorganic conditions, recommended dose of chemical fertilizers (20 kg N, 50 kg P<sub>2</sub>O<sub>5</sub> per hectare) in the form of urea and single super phosphate were used. Seed treatment was done with Bavistin @ of 3 g kg<sup>-1</sup>. For the control of leaf eating caterpillars chlorpyrifos @ 2.5 ml l<sup>-1</sup> and for the control of sucking pests monocrotophos @ of 1.6 ml l<sup>-1</sup> was applied. Cultural practices such as weeding and irrigation were followed in common for both trials to maintain good crop growth.

Observations were recorded on five randomly selected plants in each genotype for plant height, number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod

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length, number of seeds per pod, 100 seed weight, harvest index, SPAD chlorophyll meter reading at 35 DAS, SPAD chlorophyll meter reading at 50 DAS, Specific leaf area 35 DAS, Specific leaf area 50 DAS, relative water content and seed yield per plant, whereas for days to 50 per cent flowering and days to maturity observations were recorded on plot basis.

## **RESULTS AND DISCUSSION**

The results indicated that the genotypes exhibited differential performance under organic and inorganic fertilizer managements. The mean performance of 30 blackgram genotypes under organic and inorganic fertilizer management for yield and yield contributing characters were presented in Table 1 and for water use efficiency traits were presented in Table 2.

Based on the mean performance of 30 blackgram genotypes under organic and inorganic fertilizer managements, it was found that KU-12-56, PU-31, LBG-752, KU-11-685 and RFU-13-04 were high yielders under organic fertilizer management, whereas UG-708, WBG-26, VBN-7, PU-31, TBG-104 and TU-94-02 recorded high seed yield under inorganic fertilizer management.

Under organic fertilizer management, PU-31, MBG-1045, KU-10-1170, SU-13-509, MBG-1050 and PU-205 were found to be more water use efficient, while under inorganic fertilizer management the genotypes with high water use efficiency were LOP-1070, PU-31, UG-708, VBN-7, P-1032, SU-13-509, VVG-09-005 and KU-14-39.

Based on the mean performance for yield, yield contributing and water use efficiency traits the top five genotypes under organic and inorganic fertilizer managements were presented in Table 3. The genotype PU-31 showed higher performance for seed yield per plant under both organic and inorganic fertilizer managements. All other genotypes showed differential performance for yield and water use efficiency under organic and inorganic fertilizer managements suggesting the need for development of cultivars suitable for target environment.

Although plant growth was good under organic conditions compared to inorganic conditions, mean performance was low and higher yields could not be recorded under organic fertilizer management. This was due to higher pest incidence at flowering and maturity -

stages, which drastically affected the yield potential of the genotypes. However, the other reasons for lower seed yield in organic management were decreased pod length, less number of seeds per pod and low hundred seed weight. Even though good growth was observed in some genotypes which recorded greater plant height, more number of primary branches per plant, more number of clusters per plant and more number of pods per plant, the seed yield per plant was less by 40% or more in organic management. The results indicated the necessity of development of cultivars suitable for organic management conditions.

## **REFERENCES**

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## Yield related and Physiological traits of blackgram under different fertilizer managements

**Table 1. Mean performance of 30 blackgram genotypes for yield and yield component characters under organic and inorganic fertilizer managements**

Genotypes	Days to 50% flowering		Days to maturity		Plant height (cm)		Number of primary branches per plant		Number of clusters per plant		Number of pods per cluster		Number of pods per plant		Pod length (cm)		Number of seeds per pod		Hundred seed weight (g)		Harvest index (%)		Seed yield per plant (g)		
	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O
KDRS-136	42.00	41.33	68.67	71.00	43.37	45.53	3.07	2.33	11.07	8.87	3.27	2.67	33.67	22.67	4.23	4.71	4.00	6.80	3.58	4.82	6.30	16.51	1.50	5.57	
KU-10-1169	42.00	44.33	69.33	70.00	41.00	37.40	1.73	1.53	8.87	8.87	2.60	2.33	24.67	23.73	4.07	4.42	4.80	6.87	3.08	4.49	5.04	26.93	0.80	5.54	
KU-10-1170	41.33	42.33	69.67	70.00	35.27	52.07	1.73	1.47	6.80	10.67	3.27	2.73	21.47	29.33	4.01	4.67	2.73	5.93	4.71	4.81	7.05	20.70	0.79	5.18	
KU-11-685	45.00	41.00	69.67	69.33	41.87	41.53	1.93	1.60	6.80	7.87	2.67	3.20	21.13	24.20	4.01	4.29	4.80	6.13	3.36	4.34	6.68	26.17	2.09	5.15	
KU-12-56	37.00	37.67	68.67	68.33	39.07	40.93	2.60	1.27	10.20	10.00	2.73	2.67	28.40	24.33	4.07	4.84	4.27	6.27	2.81	4.98	13.30	25.28	2.78	5.65	
KU-14-01	36.33	41.00	69.33	72.67	44.20	35.33	1.80	1.60	11.93	5.73	3.00	3.13	37.23	18.20	4.05	4.21	3.87	5.60	4.81	4.33	8.39	26.21	1.47	4.23	
KU-14-39	36.33	38.67	71.67	73.00	40.13	43.47	2.27	2.00	10.87	8.00	2.33	2.73	26.87	23.93	3.99	4.55	5.73	6.33	2.99	4.21	8.76	20.07	1.07	4.86	
KU-14-47	38.33	40.00	70.33	70.33	35.00	39.97	1.73	1.47	10.27	6.73	3.00	2.93	29.93	22.53	4.09	4.45	5.40	6.07	3.06	4.98	8.68	19.06	1.27	4.40	
LBG752	39.33	41.00	68.33	65.67	46.40	41.80	1.67	2.00	5.67	5.33	2.80	3.00	19.13	16.13	4.21	3.97	2.33	5.47	3.69	4.65	5.78	17.19	2.28	3.75	
LBG787	40.33	41.67	70.33	71.67	48.27	38.53	1.67	1.53	8.87	7.27	2.93	2.93	28.40	24.67	4.34	4.71	3.00	5.93	4.13	4.37	7.12	28.76	1.40	4.90	
LOP-1070	41.67	42.67	69.67	69.00	41.67	40.53	1.53	1.53	10.60	6.47	3.20	3.07	36.07	23.53	4.14	4.12	1.73	4.93	3.64	4.13	6.47	22.76	1.15	4.33	
MBG-1045	39.00	42.33	69.00	72.00	43.47	41.07	1.93	1.73	6.00	9.60	2.73	3.07	20.87	25.67	4.25	4.32	4.33	5.80	3.91	4.20	8.83	16.49	1.44	4.87	
MBG-1050	40.00	42.00	70.00	70.67	44.93	45.33	2.13	1.93	9.87	9.87	2.87	2.67	25.47	21.27	3.82	4.85	2.47	5.87	4.26	3.99	5.05	18.94	1.15	4.62	
NDU-11-201	42.67	42.33	71.33	70.00	45.47	45.20	2.27	1.53	8.00	9.27	2.73	3.00	20.07	30.07	4.35	4.61	3.67	5.87	3.10	4.32	4.70	21.99	0.87	4.99	
P-1032	38.67	41.00	69.00	70.33	36.33	40.00	1.60	1.67	6.40	9.80	2.47	2.93	17.07	30.13	4.22	4.18	5.07	5.40	2.87	4.24	6.88	24.18	0.99	4.51	
P-112	41.00	38.67	70.67	68.33	47.73	40.40	2.13	2.73	15.27	13.60	2.87	2.87	42.80	35.93	3.63	4.21	2.07	5.60	3.02	4.46	6.21	25.09	1.45	4.74	
P-728	39.00	43.33	67.33	71.00	39.47	42.67	1.40	2.40	9.07	7.33	2.53	2.53	22.00	18.87	4.23	4.04	3.20	6.13	3.17	4.09	6.91	19.20	0.92	4.41	
PU-205	39.33	41.33	69.33	68.67	40.60	45.73	1.67	2.20	8.40	11.67	2.40	2.87	20.13	32.53	3.90	4.09	3.27	5.93	2.65	4.03	8.14	20.06	0.96	4.24	
PU-31	39.00	39.67	69.00	67.67	38.20	36.80	1.73	1.93	8.73	7.47	2.87	2.87	26.33	26.67	4.12	4.24	4.43	5.67	2.81	4.19	15.98	20.64	2.55	6.05	
RFU-13-04	43.33	42.33	71.33	71.67	47.60	41.27	1.67	2.13	9.93	6.00	2.67	2.47	28.27	21.33	3.99	4.33	3.20	5.30	2.72	3.87	7.39	21.21	2.04	3.83	
SU-13-08	42.00	40.00	71.67	69.67	39.13	38.00	1.67	2.20	6.93	8.53	2.53	3.87	19.00	32.73	4.63	4.73	2.80	5.87	3.52	4.40	6.54	16.29	1.47	5.30	

Table 1 (cont...)

Genotypes	Days to 50% flowering		Days to maturity		Plant height (cm)		Number of primary branches per plant		Number of clusters per plant		Number of pods per cluster		Number of pods per plant		Pod length (cm)		Number of seeds per pod		Hundred seed weight (g)		Harvest index (%)		Seed yield per plant (g)		
	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O
SJ-13-50	40.00	40.67	70.33	71.67	34.20	39.67	1.53	1.93	6.80	9.47	2.73	2.47	22.87	25.00	4.46	4.52	3.53	6.27	2.99	4.70	8.75	19.84	1.26	4.52	
TBG-104	39.33	39.67	68.67	69.33	40.20	44.33	1.93	2.47	10.13	10.93	2.67	2.80	28.53	30.87	4.02	5.13	4.40	7.20	3.13	4.55	8.28	27.62	1.64	5.81	
TU-94-02	40.33	37.67	69.67	67.33	45.40	40.07	1.80	2.67	8.67	8.40	3.07	2.80	27.60	24.73	4.15	4.59	3.33	6.53	4.12	3.87	3.38	21.27	1.55	5.79	
UG-708	38.00	41.00	69.00	71.00	39.73	42.47	2.40	2.07	6.53	13.07	2.87	3.07	22.53	40.73	4.01	4.35	4.27	6.93	3.64	4.24	9.28	21.39	1.62	6.44	
VVG-09-005	38.67	41.00	70.33	71.00	40.20	41.07	1.53	2.07	5.67	6.93	2.73	2.93	21.33	27.73	4.01	4.37	2.47	6.13	3.41	4.43	7.64	18.81	0.99	3.48	
VBG-11-40-1	41.00	38.67	71.67	69.00	43.33	45.20	0.93	1.53	5.40	9.07	2.07	3.20	13.80	29.07	4.18	4.85	3.67	6.60	2.67	5.22	9.01	21.56	0.90	4.99	
VEN-4	38.00	38.00	69.67	72.67	44.60	43.40	1.47	2.53	5.53	10.47	2.80	2.80	18.77	27.67	4.13	4.32	3.60	5.87	2.31	4.00	5.49	24.55	0.93	5.27	
VEN-7	38.00	37.00	70.67	66.67	37.00	38.00	1.40	2.27	5.87	11.27	2.27	3.33	18.60	36.00	4.51	4.14	4.00	5.67	2.66	3.94	8.12	21.99	1.16	6.16	
WBG-26	38.33	41.33	69.67	74.00	40.13	42.80	2.07	2.20	9.27	10.40	3.00	3.13	29.60	33.07	4.07	4.31	5.20	6.27	3.43	4.36	8.15	16.74	1.73	6.23	
Mean	39.84	40.66	69.88	70.04	41.47	41.69	1.83	1.95	8.48	8.96	2.76	2.90	25.09	26.78	4.13	4.44	3.72	6.04	3.34	4.37	7.61	21.56	1.41	4.99	
C.V.	3.85	2.68	2.12	2.30	4.92	4.82	18.79	18.96	9.42	15.06	13.38	10.27	11.27	11.63	1.99	5.19	24.53	9.98	3.54	6.93	10.36	9.34	19.66	9.52	
SE.	0.88	0.63	0.85	0.93	1.18	1.16	0.20	0.21	0.46	0.78	0.21	0.17	1.63	1.80	0.05	0.13	0.53	0.35	0.07	0.18	0.17	1.49	0.16	0.27	
C.D.5%	2.50	1.78	-	2.64	3.34	3.28	0.56	0.60	1.31	2.21	0.60	0.49	4.62	5.09	0.13	0.38	1.49	0.99	0.19	0.50	0.49	4.20	0.45	0.78	

O - Organic fertilizer management; I - Inorganic fertilizer management

Yield related and Physiological traits of blackgram under different fertilizer managements

Table 2. Mean performance of 30 blackgram genotypes for water use efficiency traits under organic and inorganic fertilizer managements

Genotypes	SPAD chlorophyll meter reading at 35 DAS		SPAD chlorophyll meter reading at 50 DAS		Specific leaf area at 35 DAS (cm <sup>2</sup> g <sup>-1</sup> )		Specific leaf area at 50 DAS (cm <sup>2</sup> g <sup>-1</sup> )		Relative water content (%)	
	O	I	O	I	O	I	O	I	O	I
KDRS-136	38.43	43.40	42.53	48.23	328.96	267.96	234.09	208.55	80.30	66.53
KU-10-1169	39.97	39.50	52.43	46.37	277.85	260.78	231.81	175.36	74.67	63.57
KU-10-1170	41.10	41.03	48.83	45.53	254.84	262.63	197.49	214.61	78.61	73.80
KU-11-685	40.97	38.97	46.27	49.30	248.91	309.41	198.59	162.25	80.51	70.58
KU-12-56	33.80	39.17	44.87	42.33	345.55	302.94	182.76	210.33	77.29	72.56
KU-14-01	39.50	39.43	46.67	49.20	275.66	312.09	214.78	144.91	77.98	76.79
KU-14-39	38.83	39.40	42.73	46.47	303.89	305.97	199.96	168.03	79.18	83.13
KU-14-47	38.50	40.10	40.50	44.90	297.16	294.52	198.18	188.27	82.88	77.42
LBG-752	38.60	39.33	44.27	43.49	283.55	321.74	157.91	206.62	77.61	78.01
LBG-787	39.27	40.07	41.70	43.83	258.05	314.82	198.26	169.13	73.49	74.23
LOP-1070	39.10	47.53	45.83	47.97	277.53	243.63	155.75	203.76	71.28	84.29
MBG-1045	41.33	42.97	45.33	47.77	298.12	295.06	187.81	194.51	80.96	82.20
MBG-1050	40.43	43.00	44.67	47.27	247.54	292.44	180.34	169.20	76.88	70.01
NDU-11-201	40.43	41.23	46.40	45.20	273.39	294.50	201.19	214.22	80.31	70.94
P-1032	40.77	45.67	46.90	49.10	300.43	221.17	198.87	187.58	84.56	77.19
P-112	40.73	41.63	51.17	47.43	260.19	307.60	199.22	182.66	75.65	72.80
P-728	40.20	41.57	45.87	47.77	274.36	292.50	200.89	186.90	73.03	80.76
PU-205	40.47	40.80	45.23	44.83	273.49	251.37	163.34	191.46	86.84	67.58
PU-31	42.13	45.67	49.73	52.00	255.66	265.45	182.47	173.25	73.03	80.98
RFU-13-04	40.27	40.60	44.40	44.30	254.70	282.42	183.99	168.73	76.53	80.48
SU-13-08	39.57	45.37	44.90	47.63	279.59	291.60	192.56	191.13	55.66	73.49
SU-13-509	41.93	47.37	47.87	55.60	268.70	283.12	157.77	171.12	76.08	70.74
TBG-104	41.27	39.53	45.90	48.83	297.88	304.10	177.65	193.69	78.07	73.50

Table 2 (cont....)

Genotypes	SPAD chlorophyll meter reading at 35 DAS		SPAD chlorophyll meter reading at 50 DAS		Specific leaf area at 35 DAS (cm <sup>2</sup> g <sup>-1</sup> )		Specific leaf area at 50 DAS (cm <sup>2</sup> g <sup>-1</sup> )		Relative water content (%)	
	O	I	O	I	O	I	O	I	O	I
TU-94-02	41.90	38.67	45.40	48.17	267.26	285.82	236.61	205.08	72.86	79.09
UG-708	39.67	40.80	42.53	51.17	263.15	303.49	209.44	165.06	76.11	71.33
VVG-09-005	39.90	33.27	37.90	51.83	257.23	299.69	188.28	163.12	82.07	75.06
VBG-11-031	40.33	40.47	45.57	50.33	277.20	280.44	202.23	190.83	76.56	76.29
VBN-4	39.00	41.03	45.37	46.90	304.45	249.27	307.17	199.15	71.83	80.04
VBN-7	41.30	43.17	44.63	51.13	257.93	268.55	181.99	169.44	72.32	82.11
WBG-26	39.70	37.60	42.70	43.30	256.82	296.02	213.10	189.56	73.75	68.51
Mean	39.98	41.28	45.30	47.61	277.34	285.37	197.82	185.28	76.56	75.13
C.V.	2.27	8.35	4.14	6.31	4.39	7.74	7.26	2.91	4.21	1.59
S.E.	0.52	1.99	1.08	1.74	7.03	12.74	8.29	3.12	1.49	0.55
C.D. 5%	1.49	5.63	3.07	4.91	19.89	36.08	23.46	8.82	4.21	1.57

O - Organic fertilizer management; I - Inorganic fertilizer management

## Yield related and Physiological traits of blackgram under different fertilizer managements

**Table 3. Summary of top five blackgram genotypes based on the mean performance for yield, yield components and water use efficiency character under organic and inorganic fertilizer managements**

S. No	Characters	Genotypes	
		Organic	Inorganic
1.	Days to 50 % flowering	KU-14-01, KU-14-39, KU-12-56, UG-708, VBN-4, VBN-7	VBN-7, KU-12-56, TU-94-02, VBN-4, KU-14-39, VBG-11-031, P-112
2.	Days to maturity	P-728, LBG-752, TBG-104, KU-12-56, MBG-1045, PU-31, UG-708,	LBG-752, VBN-7, TU-94-02, PU-31, KU-12-56, P-112
3.	Plant height (cm)	LBG-787, P-112, RFU-13-04, LBG-752, NDU-11-201	KU-10-1170, PU-205, KDRS-136, MBG-1050, NDU-11-201, VBG-11-031
4.	No. of primary branches per plant	KDRS-136, KU-12-56, UG-708, NDU-11-201, KU-14-39, MBG-1050, P-112	P-112, TU-94-02, VBN-4, TBG-104, P-728, KDRS-136
5.	No. of clusters per plant	P-112, KU-14-01, KDRS-136, KU-14-39, LOP-1070	P-112, UG-708, PU-205, VBN-7, TBG-104, KU-10-1170
6.	No. of pods per cluster	KDRS-136, KU-10-1170, LOP-1070, TU-94-02, KU-14-01, WBG-26	SU-13-08, VBN-7, KU-11-685, VBG-11-031, WBG-26, KU-14-01
7.	No. of pods per plant	P-112, KU-14-01, LOP-1070, KDRS-136, KU-14-47	UG-708, VBN-7, P-112, WBG-26, SU-13-08
8.	Pod length (cm)	SU-13-08, VBN-7, SU-13-509, NDU-11-201, LBG-787	TBG-104, MBG-1050, VBG-11-031, KU-12-56, SU-13-08
9.	No. of seeds per pod	KU-14-39, KU-14-47, WBG-26, P-1032, KU-10-1169, KU-11-685	TBG-104, UG-708, KU-10-1169, KDRS-136, VBG-11-031
10.	100 seed weight (g)	KU-14-01, KU-10-1170, MBG-1050, LBG-787, TU-94-02	VBG-11-031, KU-12-56, KU-14-47, KDRS-136, KU-10-1170
11.	Harvest index (%)	PU-31, KU-12-56, UG-708, VBG-11-031, MBG-1045	LBG-787, TBG-104, KU-10-1169, KU-14-01, KU-11-685
12.	Seed yield per plant (g)	KU-12-56, PU-31, LBG-752, KU-11-685, RFU-13-04	UG-708, WBG-26, VBN-7, PU-31, TBG-104, TU-94-02
13.	SPAD chlorophyll meter reading at 35 DAS	PU-31, SU-13-509, TU-94-02, MBG-1045, VBN-7	LOP-1070, SU-13-509, PU-31, P-1032, SU-13-08, KDRS-136
14.	SPAD chlorophyll meter reading at 50 DAS	KU-10-1169, P-112, PU-31, KU-10-1170, SU-13-509	SU-13-509, PU-31, VVG-09-005, UG-708, VBN-7
15.	Specific leaf area at 35 DAS (cm <sup>2</sup> g <sup>-1</sup> )	MBG-1050, KU-11-685, RFU-13-04, KU-10-1170, PU-31	P-1032, LOP-1070, VBN-4, PU-205, KU-10-1169
16.	Specific leaf area at 50 DAS (cm <sup>2</sup> g <sup>-1</sup> )	LOP-1070, SU-13-509, LBG-752, PU-205, TBG-104, MBG-1050	KU-14-01, KU-11-685, VVG-09-005, UG-708, KU-14-39
17.	Relative water content (%)	PU-205, P-1032, KU-14-47, VVG-09-005, MBG-1045	LOP-1070, KU-14-39, MBG-1045, VBN-7, PU-31