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Impact Analysis of Finger Millet Varieties on Yield and Income of the Farmers in Mandya District, Karnataka

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Authors' contributions

This work was carried out in collaboration between all authors. Author DR designed the study, performed the statistical analysis, wrote protocol and wrote the first draft of the manuscript. Authors MV and CU managed the analysis of the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The Finger Millet (*Eleusine coracana* L.) is a staple food in southern Karnataka popularly known and called as 'Ragi' in Indian vernacular language. To enhance its productivity the University of Agricultural Sciences, Bengaluru (UASB) is engaged in evolving location specific, farmer need based farm technologies through its Zonal Agricultural Research Stations (ZARS) spread over in Southern Karnataka since its inception 1965. To its credit, it has developed and released many farm technologies for the farmers to adopt. Among these, the improved high yielding Finger Millet variety KMR-204 was one. It has genetic advantages over the other local varieties, such as high yielding, blast tolerance, short duration and preferred for late sowing when rains are delayed. Such improved variety was released and recommended during 2011 for wider adoption for the growers in southern dry zone of Karnataka. Since then, many growers had adopted the variety. After lapse of 5 years of

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its release, the UASB was interested in to find out the performance of the technology on the farmers field and their perception in gaining economic returns when compared to other local varieties. From this backdrop the study was conducted during 2016 in Mandya district, Karnataka, where there is large area under the Finger Millet crop. The district has 7 taluks, from each taluk 2 Finger Millet growing villages were selected. From 14 villages, 210 respondents who have adopted both KMR-204 and Indaf -9 varieties (Before) were selected randomly and interviewed and information was collected. A research design 'Before and After' was adopted to compare the results. The findings of the study reveal that, the KMR-204 had given more grain and straw yield compared to that of Indaf-9 variety used before under both rainfed and irrigated conditions. However, the difference in obtaining grain and straw yields was non-significant. Similarly, in case of obtaining net income, though the respondents obtained relatively more income from KMR-204 compared to Indaf-9, the difference was non-significant. Thus the alternate hypothesis is rejected by accepting the null hypothesis. The respondents had favourable perception, with high attibutional quotient (0.92) towards KMR-204, implying speedier diffusion of technology in the social system for adoption. To conclude that the respondents obtained almost equal yields and income from the from the selected Finger millet varieties. The respondents had favourable perception (attributional index-0.92) towards KMR-204 variety, implying speedier diffusion of technology in to the social system in due course of time.

Keywords: Attributional quotient; diffusion; grain yield; net income.

1. INTRODUCTION

The Finger Millet (*Eleusine coracana* L.) is Iron rich food, with low fat diet and other minerals, has therapeutic value for persons suffering from diabetic disorder, where in, large population in India are suffering from it. As to make prescriptive diet there is need to produce voluminous quality bulk to meet the huge demand. It is a staple food crop in southern Karnataka and large area in under the crop.

The food production in Karnataka State is set to fall short of the stated target (140 lakh tones) by a whopping 35% in the current financial year on account of successive years of drought [1]. To address this the reasons are to be ascertained through conducting impact assessment studies. The University of Agricultural Sciences, Bengaluru is one of the premiere Universities of India, has been engaging in evolving location specific, farmer need based technologies through its Zonal Agricultural Research Stations (ZARS) spread over in Southern Karnataka since its inception 1965. One such ZARS is located in VC Farm, Campus Mandya district. It has come out with many novel technologies, among them the Finger Millet crop new improved high yielding variety KMR-204 (Karnataka MandyaRagi) was one, which was released during 2011, for the benefit of the farming community [2].

The present study was conducted to assess the impact of Finger Millet var. KMR-204. which was released during 2011 from ZARS and recommended for farmers to adopt to obtain better yield and income. The UASB has funded this project to find out the impact of the released and recommended technologies from ZARS, on the crop yields and income of the farmers and the extent of area covered under the technologies.

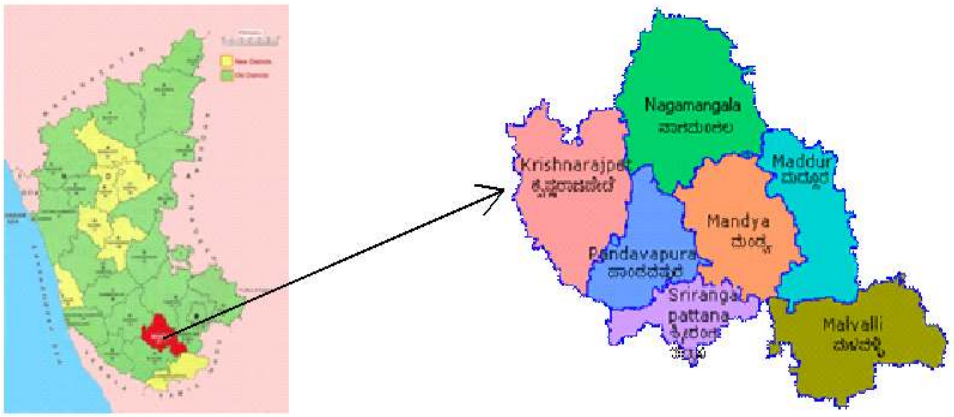
Keeping the above background in view the study was conducted in the year 2016-2017 with the objectives of finding of the impact of Finger Millet varieties on yield and income of the respondents both in rainfed and irrigated conditions and finding the attibutional quotient of farmers of selected Finger millet varieties.

2. MATERIALS AND METHODS

2.1 Location of the Study

The study was conducted in Mandya district, Karnataka, which has 7 taluks, from each of the taluk, 2 villages were selected [3]. The sample of respondents for the study was, the finger millet growers who adopted both KMR-204 and Indaf-9 varieties. A list such adopters was obtained from ZARS, Krishi Vigyan Kendra (KVK) and Karnataka State Department of Agriculture (KSDA) Mandya. Through cluster sampling method 210 respondents were selected randomly.

Study Area:



Karnataka state **Mandya district**

Selection of villages: Sample size

Sl. no	Taluk	Villages	Respondents
1	Mandya	Holalu	15
		Modachakanahalli	15
2	Maddur	Doddarasinakere	15
		Kesthur	15
3	Srirangapatna	Arakere	15
		Kodiyala	15
4	Pandavapura	Kythanahalli	15
		Doddabyadarahalli	15
5	K.R.pete	Bandihole	15
		Beriya	15
6	Nagamangala	Devalapura	15
		Bindenahalli	15
7	Malavalli	Kirgavalu	15
		Hittanahallikoppalu	15
	Total		**210**

The Research design adopted was “Before and After” type, evaluation study. The variables selected for the study were grain and straw yield, the net income. The yield was measured actual Finger millet grain yield obtained by the respondents (q/ac), the Finger millet straw in terms of tons/ac, and the net income obtained in terms of Rs./ac considering the produce sold and cost of cultivation. The information was sought from the respondents based on their memory lane ‘recall’ method. The variable attributional quotient is a qualitative variable indication perception of respondents regarding attributes of technologies. It was quantified for Ragi-KMR-204 variety. The five attributes have been considered [4]. viz., Simple to understand, Profitability, Compatibility with socio-cultural system, Eco-friendly and impact Visibility to the eyes. For each of the attributes the respondents were asked to give opinion ‘Yes’ or ‘No’, a score 2 was given for ‘Yes’ response and score ‘1’ for ‘No’ response. A total maximum possible score for five attributes would be 2100. The quotient was calculated with the formula. Higher the quotient speedier of technology diffusion in the social system.

$$\text{Attibutional quotient} = \frac{\text{Total score obtained}}{\text{Maximum score possible}}$$

Quotient range	Interpretation
>0.80	High rate of diffssion
0.60 to 0.79	Moderate disffuison
<0.59	Slow diffussion

The Instruments employed for data collection were, interview schedule, Participatory Rural

Appraisal (PRA) tools and focus group discussion. The data were collected during November 2016 to February 2017. Hypothesis set for the study was, there is difference between the two varieties (KMR-204 and Indaf-9) with respect to yield (grain and straw) both in rainfed and irrigated conditions (Alternate hypothesis). There is difference between the two varieties (KMR-204 and Indaf-9) with respect to net income gained both in rainfed and irrigated conditions (Alternate hypothesis). The data were analysed by employing simple statistical tools such as frequency and per cent, paired 't' test to draw the inferences.

3. RESULTS AND DISCUSSION

The findings of the study are presented and discussed as per the objectives wise for the study. To find out the impact of Finger Millet varieties on yield and income of the respondents both in rainfed and irrigated conditions and to find out the attibutional quotient of farmers of selected Finger millet varieties. To find out the impact the Finger Millet var. KMR-204 was compared with variety Indaf-9, both are short duration and late sown varieties for both rainfed and irrigated conditions.

3.1 Comparative Average Grain Yield of Finger Millet Improved Varieties under Rainfed Condition

The findings revealed that the respondents had obtained grain yield of 7.80q/ac from the KMR-204 and 6.36 q/ac from the Indaf-9 variety. The KMR-204 variety recorded a marginal increase in grain yield of 1.43 q/ac (Table-1 and Fig. 1). The difference in getting the yield it was non-significant (t=00.16). In case of straw yield the findings reveal that the respondents had obtained straw yield 1.47t/ac from the KMR-204 and 1.19t/ac from the Indaf-9 variety. The KMR-204 variety had given a marginal increase in straw yield of 0.28t /ac (Table-2 and Fig. 2). In case of straw yield also there was a non-significant difference was found (t=0.18). The reasons could be better genetic yield potential of KMR-204 var., its tolerance to blast disease and management practices adopted by the respondents [5]. Thus the null hypothesis is accepted by rejecting the alternate hypothesis set for the study.

3.2 The Net Income Obtained From Improved Varieties of Finger Millet Rainfed

The net-income obtained from KMR-204, was Rs. **24394/ac** (Table-3 and Fig. 3). In case of Indaf-9, it was Rs. **16785/ac.** The additional income obtained from the KMR-204 var., was **Rs. 7609/ac.** The possible reasons could be its tolerance to blast disease and fetching better market price for its quality grains. There was no significant difference between varieties (t=0.06) in getting more net income.

3.3 Comparative Grain Yield obtained from Finger Millet Improved Varietiesunder Irrigated Condition

The average grain yield obtained by the respondents from the KMR-204 variety was 12.54 q/ac. In case of variety Indaf-9 it was 11.5 q/ac. The former yielded slightly more yield 1.02 q/ac (Table 4 and Fig. 4). However, there was no significant difference between the two varieties (t=0.19). In case of the average straw yield, the respondents obtained 1.82 t/ac from

Table 1. Comparative average grain yield of finger millet varieties KMR-204 & Indaf-9: Rainfed (n=210)

Sl. no.	Taluk	After (KMR-204) (quantals/ac)	Before (Indaf-9) (quantals/ac)	Yield difference (q/ac)	Paired 't' test
1	Pandavapura	8.12	6.12	2.00	
2	Maddur	7.56	5.80	1.76	
3	Mandya	8.25	6.92	1.33	
4	S.R.patna	7.76	6.21	1.56	0.06NS
5	K.R.Pete	8.50	7.10	1.40	
6	Nagamangala	7.32	6.30	1.02	
7	Malavalli	7.12	6.10	1.02	
	Average	**7.80**	**6.36**	**1.44**	

NS:Non significant

KMR-204, in case of variety Indaf-9 it was 1.63 t/ac. The former yielded is slightly more, 0.28t/ac (Table 5 and Fig. 5). However, there was no significant difference between the two varieties (t=0.09) in straw yields. The reasons could be advantage of tolerance to the that blast disease and might have responded better for the applied fertilizers under irrigation condition [6-8]. Thus, the null hypothesis of no difference is accepted by rejecting the alternate hypothesis.

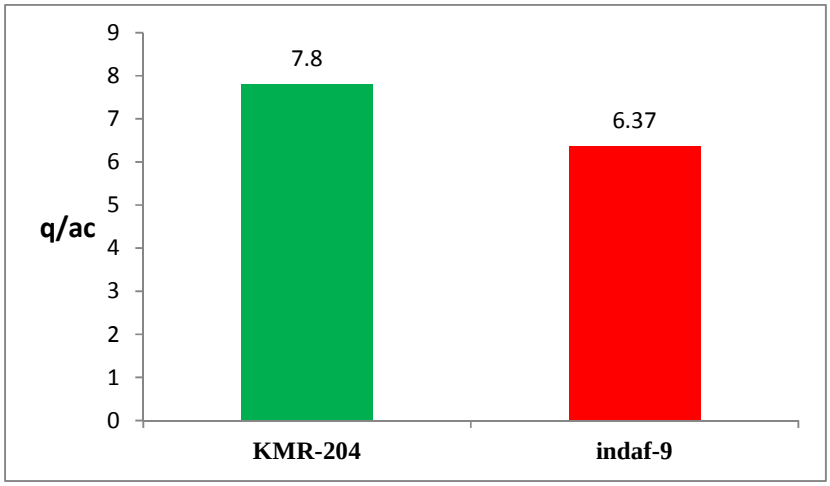


Fig. 1. Comparative average grain yield of Finger Millet var. KMR-204 & Indaf-9: Rainfed condition

Table 2. Comparative average straw yield of finger millet varieties KMR-204 & Indaf-9: Rainfed (n=210)

Sl. no.	Taluk	After (KMR-204) (quantals/ac)	Before (Indaf-9) (quantals/ac)	Yield difference (q/ac)	Paired 't' test
1	Pandavapura	1.30	1.20	0.10	
2	Maddur	1.49	1.02	-0.47	
3	Mandya	1.56	1.30	0.26	
4	S.R.patna	1.42	1.25	0.17	0.18NS
5	K.R.Pete	1.82	1.45	0.37	
6	Nagamangala	1.38	1.12	0.26	
7	Malavalli	1.32	1.03	0.29	
	Average	**1.47**	**1.19**	**0.28**	

NS-Non significant

Table 3. Additional net Income obtained by using varieties KMR- 204 and indaf-9 (n=210)

Sl.no.	Taluk	Var. KMR-204 net income (Rs)	Var. Indaf-9 net income (Rs)	Difference (Rs)	Paired 't' test
1	Pandavapura	25388.10	16246.04	9142.06	
2	Maddur	23670.10	13314.92	10355.18	
3	Mandya	29659.45	20889.54	8769.91	
4	S.R.patna	20839.12	17836.60	3002.52	0.06NS
5	K.R.Pete	28668.10	18068.75	1059935	
6	Nagamangala	21332.50	16412.50	4920	
7	Malavalli	21203.80	14731.57	6472.23	
	Average	**24394.35**	**16785.70**	**7608.65**	

NS-Non significant

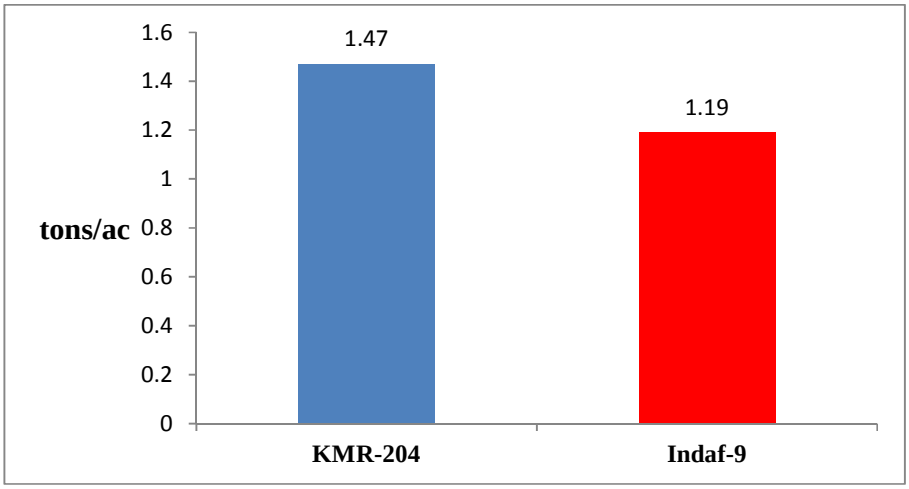


Fig. 2. Comparative average straw yield of finger millet varieties KMR-204 & Indaf-9: Rainfed condition

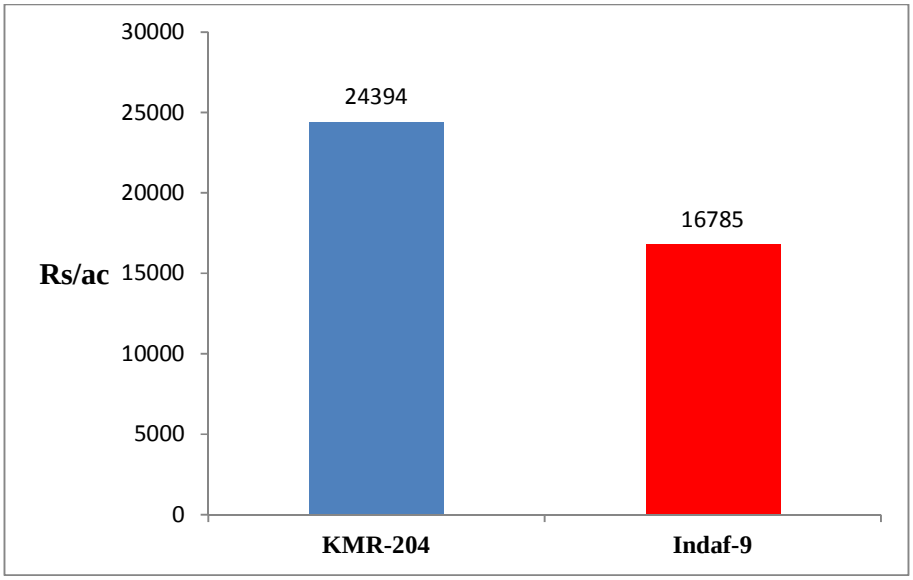


Fig. 3. Additional net income obtained by using varieties KMR- 204 and Indaf 9

3.4 Comparative Net Income Obtained from Finger Millet Improved Varietiesunder Irrigated Condition

The net income obtained by the respondents from Indaf-9 variety was Rs.32497/ac (Table-6 and Fig. 6). In case of KMR-204, it was Rs. **36808.** The additional income obtained by the respondents was Rs. **4311.** However, there was no significant difference between the two varieties (t=0.16) in obtaining additional income. The plausible reason could be that, from the table it could be observed that there was non-significant difference in obtaining yield from the two varieties, when sold the produce in the market, the respondents fetched almost same market price thus, the income accrued from this would also be almost equal.

3.5 Perception of Respondents Regarding Attributes of KMR-204

Majority of the respondents (95%) perceived that the KMR-204 variety was simple to understand, profitable (87%). All the respondents opined it was social and culturally compatible to grow and could be used for consumption and eco- friendly. However, majority of them (53%) of the

perceived that the impact was not visible to the eyes for conviction (Tables 7 and 8 Fig. 7). The overall quotient of attributes all together was 0.92, implying favourable perception towards KMR-204 variety and speedy diffusion of variety in the social system for adoption [9-11].

Table 4. Comparative average grain yield of finger millet varieties KMR-204 & Indaf-9: Irrigated condition (n=210)

Sl. no.	Taluk	After (KMR-204) (quantals/ac)	Before (Indaf-9) (quantals/ac)	Yield difference (q/ac)	Paired 't' test
1	Pandavapura	13.50	11.50	2.00	
2	Maddur	12.52	12.00	0.52	
3	Mandya	13.25	13.00	0.25	
4	S.R.patna	11.92	11.58	0.34	0.19NS
5	K.R.Pete	12.60	11.06	1.54	
6	Nagamangala	11.90	10.50	-1.40	
7	Malavalli	12.12	11.00	1.12	
	Average	**12.54**	**11.50**	**1.04**	

NS-Non significant

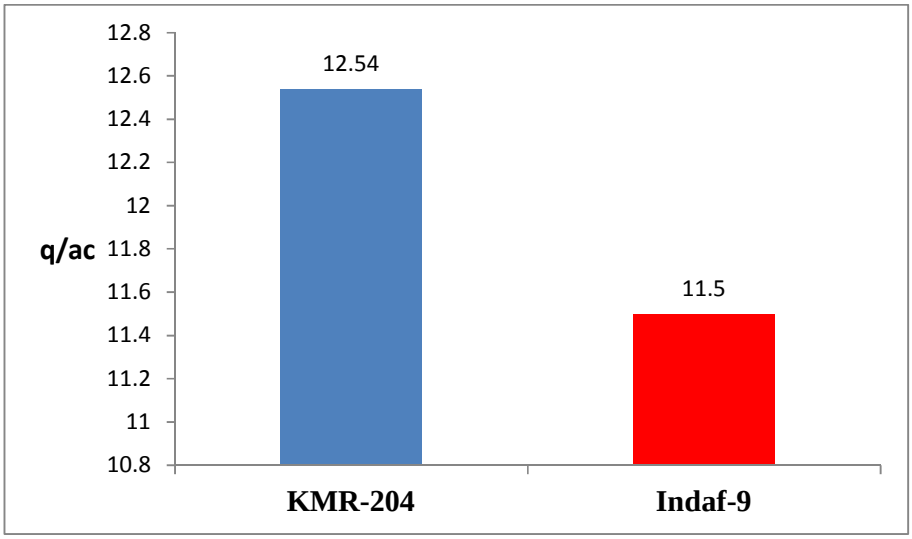


Fig. 4. Comparative average grain yield of finger millet varieties KMR-204 & Indaf-9: Irrigated condition

Table 5. Comparative average straw yield of finger millet varieties KMR-204 & Indaf-9: Irrigated condition (n=210)

Sl.No.	Taluk	After (KMR-204) (quantals/ac)	Before (Indaf-9) (quantals-/ac)	Yield difference (q/ac)	Paired 't' test
1	Pandavapura	1.92	1.62	0.30	
2	Maddur	1.79	1.77	0.02	
3	Mandya	1.87	1.84	0.03	
4	S.R.patna	1.66	1.65	0.01	0.09 NS
5	K.R.Pete	1.82	1.52	0.30	
6	Nagamangala	1.65	1.49	0.16	
7	Malavalli	1.32	1.53	-0.19	
	Average	**1.82**	**1.63**	**0.19**	

NS-Non significant

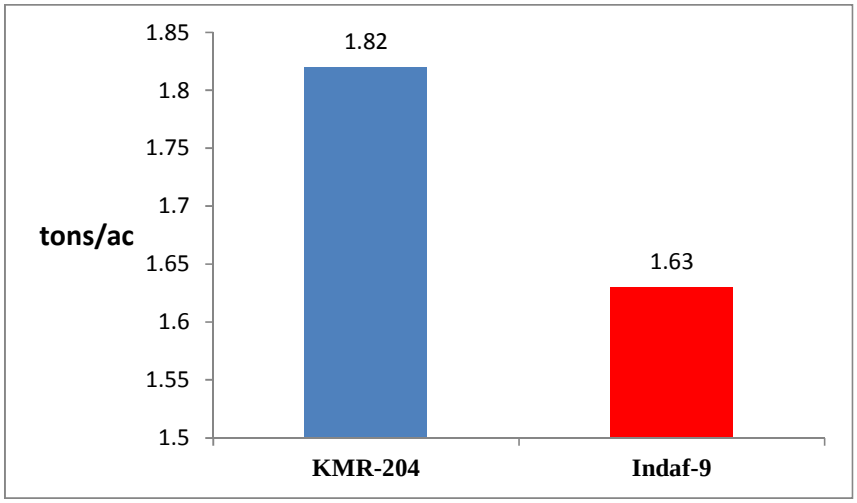


Fig. 5. Comparative average straw yield of finger millet varieties KMR-204 & Indaf-9: Irrigated

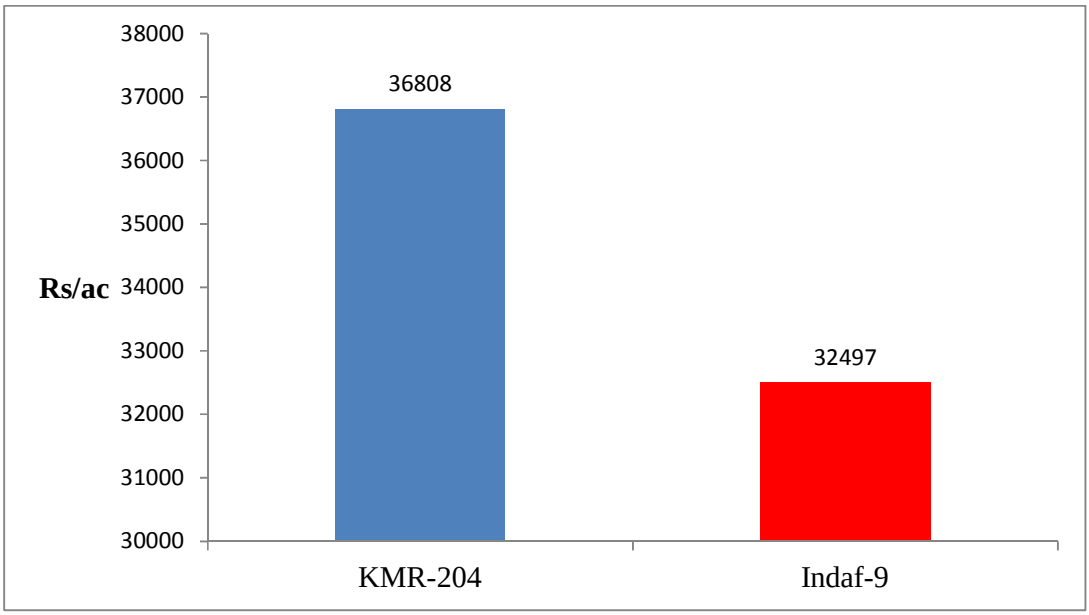


Fig. 6. Additional net income obtained by using varieties KMR- 204 and indaf 9: Irrigated conditon

Table 6. Additional net income obtained by using varieties KMR- 204 and indaf-9: Irrigated condition (n=210)

Sl.No.	Taluk	KMR-204 net income (Rs)	Indaf-9 net income (Rs)	Difference	Paired test 't' value
1	Pandavapura	38755.16	31974.26	6780.9	
2	Maddur	34456.86	33844.71	612.15	
3	Mandya	43074.15	40332.32	2741.83	
4	S.R.patna	29347.00	29243.45	103.55	0.16NS
5	K.R.Pete	36234.90	29970.94	6263.96	
6	Nagamangala	36098.75	30456.77	5641.98	
7	Malavalli	33310.68	31628.19	1682.49	
	Average	**36808.07**	**32497.24**	**4310.83**	

NS-Non significant

Table 7. Opinion about the attributes of the selected technologies as perceived by the respondents (n=210)

Sl. no	Taluks	Simple to understand (Number of respondents)		Profitability (Number of respondents)		Social – cultural compatibility(Number of respondents)		Eco – friendly (Number of respondents)		Impact visibility (Number of respondents)		Total (Number of respondents)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Pandavapura	28	2	26	4	30	0	30	0	12	18	126	24
2	Maddur	29	1	26	4	30	0	30	0	9	21	124	26
3	Mandya	30	0	24	6	30	0	30	0	13	17	127	23
4	S.R.patna	28	2	27	3	30	0	30	0	14	16	129	21
5	K.R.Pete	29	1	27	3	30	0	30	0	18	12	134	16
6	Nagamangala	28	2	27	3	30	0	30	0	23	7	138	12
7	Malavalli	28	2	26	4	30	0	30	0	9	21	123	27
Total		**200**	**10**	**183**	**27**	**210**	**0**	**210**	**0**	**98**	**112**	**901**	**149**
Percentage		**95.23**	**4.76**	**87.14**	**12.85**	**100**	**0**	**100**	**0**	**46.67**	**53.33**	**85.80**	**14.20**
Attributional quotient													

(1-Simple to understand, 2-Profitability, 3-Social-cultural compatibility,4- Eco-friendly, 5-Impactvisibility)

Table 8. Farmers perception towards Finger millet and its attributional quotient, KMR -204 (n=210)

Attributes of technology	Simple to understand		Profitability		Social –cultural compatibility		Eco-friendly		Impact visibility		Total		Total score obtained	Attributional quotient
Respondents	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**		
Respondents	200	10	183	27	210	0	210	0	98	**112**	901	149	1951	**0.92**
Obtained score	400	10	366	27	420	0	420	0	196	**112**	1802	149		

(Score 2 for 'Yes' and 1 for 'No' response;)

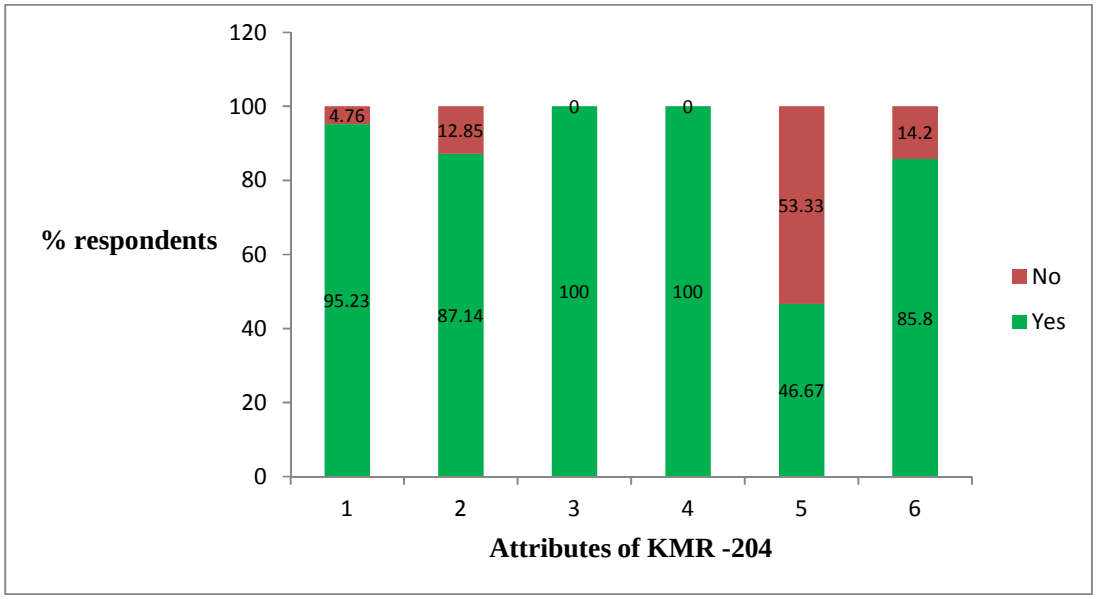


Fig. 7. Perception about improved variety KMR-204
(1 for simple to understand, 2 for profitability, 3 for scio cultural compatability, 4 for eco-friendly, 5 for impact visibility)

4. CONCLUSION

The study was conducted in Mandya district of Karnataka during 2016 with the objectives of finding out additional yield and income obtained because of introdcution of high yielding Finger Millet variety KMR-204, over the other variety Indaf-9. The study found that The KMR-204 had yielded more maginal grain and straw yields, compared that of Indaf-9 variety adopted before, by the respondents. However, the difference was non significant both in rainfed and irrigated conditions. Similarly, in obtaining additional net income also, the KMR-204 had given more additional net income comapred to that of Indaf-9 vareity. However the diffrence was non significant. The respondents had favourable perception towards KMR-204 variety with attributional index of 0-92,implying willing to continue the variety in future and there is a potential scope for speedier diffusion of KMR-204 variety in the social system for adoption**.** The implications being, suffcient seeds of KMR-204, should be made availble to the farmers in the market through seed chain-linkages involving, Raitha Samparka Kendras of Govt., Department of Agriculture, Farmers Cooperative Societies, Women Self-help Groups for distribution. The production of seeds through contract farming and seed villages from farmers should be further encouraged for large scale production. The seeds should also be made available at subsidised rate as an incentive for wider adoption and income earning.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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