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## **Farmers' Perception of Farm University Sugarcane Technologies in Karnataka, India**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author DR was the principal investigator of the research project, designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author MV was the co-principal investigator of the research project and they managed the analyses of the study. Author MNV was the co-principal investigator of the research project and managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The Zonal Agricultural Research Station, University of Agricultural Sciences, Bangalore, has been carrying out the research on major crops like Rice (*Oriza sativa* L.), Finger millet (*Eleusine coracana*), Sugarcane (*Saccharum officinarum*), Maize (*Zea mays* L.) etc., considering the agro-climatic, location specific and need based demands of the farmers since its inception 1930s, many good agricultural practices were developed and they were transferred to farmers. There was need to evaluate the performance of these technologies in farmers' field from time to time. One such technology selected for the study is, the sugarcane variety CO-86032 which was released during 2003-04 and it was compared with the local prevailing check variety CO-62175. An *Ex-post-facto* survey type of research design was adopted. The research objectives of the study are to find out

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the perception of farmers regarding performance of these farm technologies on their field regarding cane yield, income generated out of it and to find out association between cane yields and social factors affecting it. The study was conducted in Mandya, Maddur and Srirangapatna taluks of Mandya district, Karnataka state during 2009-10 and was retested in 2016 on pilot sample to ascertain the impact and performance of technologies among the farmers. The sample size was 270 and the respondents were selected randomly and purposively from afore said taluks of Mandya district. The data were collected from the respondents by administering pre-tested, structured interview schedule. The nominal data were analyzed using Chi square test to draw the inferences. The study found that the local variety CO- 62175 yielded 3.73 ton/ac cane yield more than that of CO- 86032. Majority of the respondents had harvested the cane yield ranging from 51 to 55 ton/ac, from CO-62175 and 56 to 60 ton/ac from CO-62175. Similar cane yield trend was observed in all the three taluks of Mandya district for both the varieties. Regarding jaggery recovery, the respondents obtained 120 kg of jaggery per ton of cane crushed from CO-86032 compared to 95kg from variety CO-62175, around 25 kg additional jaggery was recovered by crushing one ton cane from CO-86032. The perceived reason of respondents was more quality jiggery recovery from crushing the cane and they were willing to adopt the CO-86032 than that of CO-62175 variety. In case of finding out the association between the cane yield and the social variables; family size, land holding and education level of respondents found to have no significant association. It implies that all the 3 independent social variables had no influence on cane yield including the education level. The literacy had not played a key role in enhancing the crop yields. Both illiterate and literate respondents had obtained same crop yield without much difference. The implications of the findings are, though the cane yield of CO-86032 is relatively less compared to CO-62175, majority of the farmers were willing go for continued adoption of it, as it had multiple advantages, such as, high sugar content, pleasant color of consumer preference, better market price etc. Thus it should be promoted in large area in the Mandya and adjoining districts of Karnataka where similar agro climatic conditions exists. Further, there is a need to evolve high yielding varieties retaining the some of its beneficial attributes of CO-86032.

**Keywords:** Sugar content; jaggery recovery; cane yield; continued adoption; family size; landholdings.

## 1. INTRODUCTION

Quite often, the Indian farmers have been exposed to uncertainties as the farming is governed by vagaries of monsoon, facing many socio-economic and marketing problems [1]. They required high yielding eco-friendly innovations to double the yield and income of farmers by conducting research on manipulation of genetic and management practices [2,3]. From this back drop, the Zonal Agricultural Research Station (ZARS) Mandya, University of Agricultural Sciences (UAS), Bangalore has been carrying out the research on major crops like Rice (*Oriza sativa* L.), Finger millet (*Eleusine coracana*), Sugarcane (*Saccharum officinarum*), Maize (*Zea mays* L.) etc., considering the agro-climatic, location specific and need based to increase yield potential in the afore said crops.

The earlier sugarcane varieties were of low yielding and had low sugar content and jiggery recovery and less worthy to export it. Thus, the farmers were looking for high yielding varieties such as CO-86032. The salient features are; it is

an early-to-mid-late maturing variety with sparse and delayed flowering and suitable for all the seasons, good jaggery quality, good ratooner, suitable for wide row spacing (150 cms) and with higher cane (14%) and sugar (16%) yield over the local prevailing CO-62175 variety. This technology was transferred to farmers through University of Agricultural Sciences (UAS) extension system, Karnataka State Department of Agriculture (KSDA), Indian Council of Agriculture Research (ICAR) in Mandya, Chamarajanagar, Mysore, Tumkur and Hassan districts of Karnataka [4]. The present study was conducted to evaluate the sugarcane variety CO-86032 which was released by the UAS Bangalore during 2003-04 [5].

The objectives of the study are; to find out the performance of the sugarcane varieties in the farmers' field with respect to cane yield and income as perceived by them and to find out association between cane yields and social factors affecting it. The study was conducted in Mandya district during 2009-10 and was retested in 2016 on pilot basis to ascertain the impact and performance of technologies in the farmers field.

The UAS, Bangalore has funded this project. The UAS Bangalore wish to evaluate the performance of the technology in the farmers' field and their perception to continue it or not [6]. Considering this statement of problem, the alternative hypothesis ( $H_1$ ) was set. There would be difference in the cane yield between the two varieties of CO-86032 and CO-62175. There would be a significant association between the cane yield and the social factors of the respondents.

## 2. MATERIALS AND METHODS

### 2.1 Location of the Study

The study was conducted in Mandya district, consisting of seven taluks, viz., Mandya, Maddur, Srirangapatna, K.R.Pet, Pandavapura, Malvalli and Nagamangala. Out of these, three taluks viz., Mandya, Maddur and Srirangapatna were purposively selected for the study, where more number of farmers had adopted the technologies (Fig. 1).

### 2.2 Sample Size

The farmers who had adopted the sugarcane CO-86032 and CO-62175 varieties in Mandya district were enlisted. A total of 270 respondents (135 from each of the varieties) were randomly and purposively selected from all the 3 taluks of Mandya district (Table 1).

### 2.3 Research Design

An *Ex post facto* Exploratory type of study, as the events of the phenomenon have already occurred. The instruments used for data collection were, interview schedule, participatory rural appraisal tools (transact walk, resource mapping and focus group discussions) to supplement the information [6]. A pre-tested, structured interview schedule was developed. The contents were framed with a logical flow including both close and open end type of statements. The interview schedule was administered to the respondents by interviewing them in person in an undisturbed conditions without on-lookers influence. The data were collected and the same was analyzed by using the simple statistical tools to draw the inference.

### 2.4 Variables of the Study

The dependent variable of the study was cane yield; this has been defined as physical quantity of cane yield obtained by the respondent measured in ton/ac. The three independent variables were selected to find out the association are, family size, land holding and education level of the respondents. The variable, 'family size' is measured by categorizing into two categories, small and large families. The small family is defined as 2 to 4 members living under single roof i.e., wife and husband with children and parents. The large family is one with more

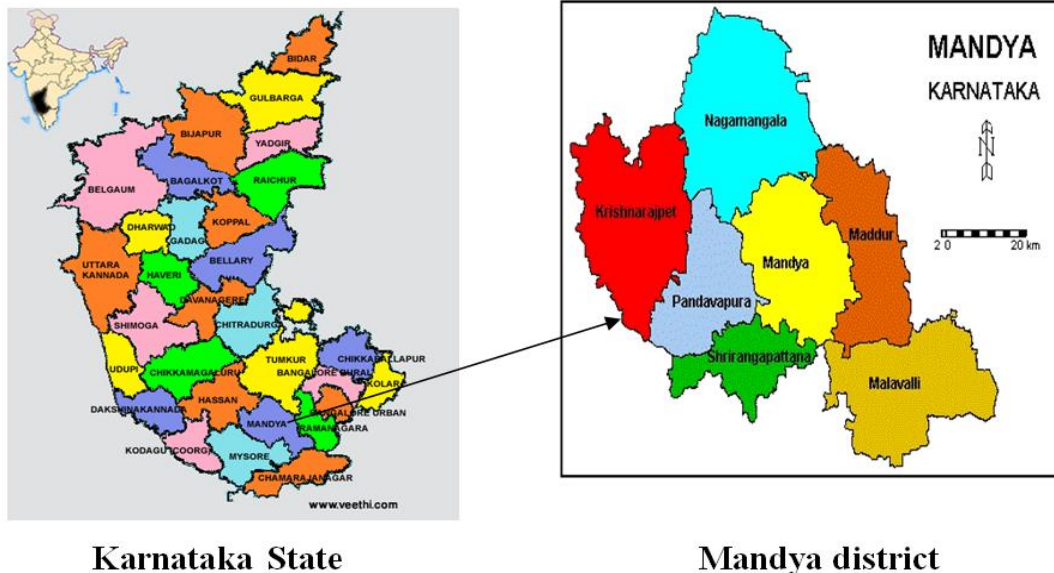


Fig. 1. Study area

**Table 1. Study area and sample size**

Sl. no.	Taluk	Villages	Sample size (No)		Total
			Study group	Control group	
1	Mandya	09	45	45	90
2	Maddur	09	45	45	90
3	Sriranagapatna	09	45	45	90
<b>Total</b>		<b>27</b>	<b>135</b>	<b>135</b>	<b>270</b>

than 6 members living under single roof i.e., wife and husband with their close family blood relation kith and kin. The variable 'Education' is categorized into two: illiterates and literates. The latter refers to functional literacy and school passed out. The variable 'Land holding' is categorized into two; small farmers owning land up to 2 ha and medium farmers owning 2 to 4 ha of cultivated land. The data were collected from the respondents by administering a pre-tested, structured interview schedule. The nominal data were analyzed by using statistical 'chi' square test to find out the association between dependent and independent variables [7]. The other simple tools like percentage and frequency were employed to draw the inference.

### 3. RESULTS AND DISCUSSION

The results emanated from the study are discussed as per the statement of the problem and objectives of the study. To find out the performance of the sugarcane varieties in the farmers' field with respect to cane yield and income as perceived by them and to find out association between cane yields and social factors affecting it.

#### 3.1 The First Objective

1. The cane yield difference between varieties CO- 62175 and CO- 86032
  - a) Distribution of respondents with respect to cane yield obtained from CO- 86032.
  - b) Distribution of respondents with respect to cane yield obtained from CO-62175.
  - c) Comparison of yield and income obtained from sugarcane varieties CO- 86032 and CO-62175.
  - d) Perceived reasons of respondents to adopt or discontinue the sugarcane variety CO-86032 in comparison with variety CO-62175.
2. Association between cane yield of CO- 86032 and the social variables; family size, land holding and education level of the respondents.

#### 3.1.1 The cane yield difference between varieties CO- 86032 and CO- 62175

The difference between the crop yields of the two sugarcane varieties were compared with respect to physical cane yield. It was found that the variety CO- 62175 yielded 3.73 ton/ac more than that of CO- 86032 (Table 2 & Fig. 2). The possible reasons could be genetic potential of CO-62175 and to some extent the management practices adopted by the farmers [8]. The alternative hypothesis of difference in cane yield has been accepted by rejecting the null hypothesis of no difference. The findings are in tune with [9].

##### 3.1.1.1 Distribution of respondents with respect to cane yield obtained from CO-86032

Majority of the farmers (68 %) harvested the cane yield ranging from 51-55 ton/ac. Similar yield trend was observed in all the three taluks. The minimum and maximum yield was 42.0 and 55 ton/ac respectively and the average yield was 51.91 ton/ac (Table 3 and Fig. 3).

##### 3.1.1.2 Distribution of respondents with respect to cane yield obtained from CO-62175

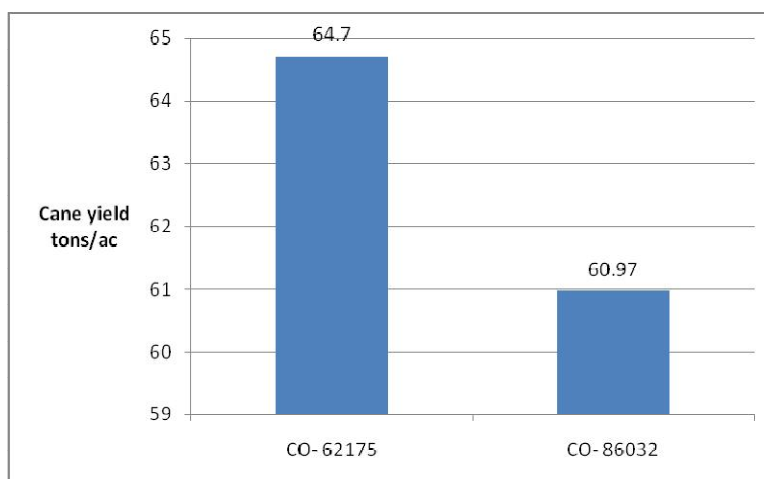
Majority of the farmers (59.26%) harvested the yield ranging from 56-60 ton/ac. A few of them (14.07%) also obtained high yield ranging from 61-64 ton/ac. Similar yield trend was observed in all the three taluks. The minimum yield recorded was 45.0 ton/ac and the maximum was 64.0 ton/ac and average yield was 62.19 ton/ ac (Table 4 and Fig. 4). The cane yield depends on ratooning ability [10].

##### 3.1.1.3 Comparison of cane yield and income of both the sugarcane varieties CO-86032 and CO-62175

The farmers obtained 120 kg jaggery per ton of cane yield crushed from variety CO-86032 with minimum of 118 kg/ton and the maximum of 128 kg/ton when compared with that of CO-62175 (95 kg/ton). Around 25 kg of additional jaggery

**Table 2. Cane yield difference between sugarcane varieties CO- 62175 and CO- 86032**

				N=270
S. no	Taluks	Variety CO- 62175 (ton/ac)	Variety CO- 86032 (ton/ac)	difference (ton/ac)
1	Mandya	62.7	59.6	3.1
2	Maddur	66.9	61.3	5.6
3	Srirangapatna	64.5	62.0	2.5
	<b>Average</b>	<b>64.70</b>	<b>60.97</b>	<b>3.73</b>

**Fig. 2. Cane yield difference between sugarcane varieties CO- 62175 and CO- 86032****Table 3. Distribution of respondents according to cane yield obtained from CO-86032 variety**

Yield range (ton/ac)	N=135							
	Mandya		Maddur		Srirangapatna		Total	%
	No	%	No	%	No	%	No	%
41-45	6	13.0	5	11.0	3	7.0	14	10.0
46-50	9	20.0	12	27.0	9	20.0	30	22.0
51-55	30	67.0	28	62.0	33	73.0	91	68.0
<b>Total</b>	<b>45</b>	<b>100.0</b>	<b>45</b>	<b>100.0</b>	<b>45</b>	<b>100.0</b>	<b>135</b>	<b>100.0</b>

(Minimum: 42.0 ton/ac Maximum: 55.0 ton/ac; Average: 51.91 ton/ac)

was recovered by crushing one ton cane, because of this reason, the farmers prefer to sell the cane of CO-86032 to the jaggery units (quoted higher price) than that of the sugar factories (Table 5). The quality of the products fetches more price [11]. The results further reveals that the farmers were losing the returns to the tune of Rs. 979/- per acre as compared to variety CO-62175. The extent of yields depends on several factors such as management of inputs [12].

#### 3.1.1.4 Perceived reasons of respondents to adopt or discontinue the sugarcane variety CO-86032

Majority of the respondents (>50%) perceived that the CO-86032 was better than that of CO-

62175 and wish to continue because of its good attributes such as, sugar content, jaggery units offered more price, preferential marketable jaggery color and its early maturity (Table 6). They also likely to discontinue it, in future because they perceived that it was less yielder, less tillering, less capacity of ratooning and requires more input and management cost compared to Co-62175 variety [13].

### 3.2 The Second Objective

#### 3.2.1 Association between cane yield and the social independent variables

Study of socio-economic attributes of farmers would help in reasons for adoption and rejection of technologies [14].

### 3.2.1.1 Association between cane yield (sugarcane variety CO-86032) and the family size

It was found that there was no significant association between cane yield and family size (Table 7). It implies that irrespective of family size, the respondents had obtained same cane yield without much difference (chi square 5.26). The possible reasons for this could be the non-involvement of children in farming as they were sent to school for education and the adult members dependency in non-agricultural income sources from nearby cities and towns to supplement the family livelihood. The alternate hypothesis ( $H_1$ ) of association between the cane yield and family size is rejected and the null hypothesis ( $H_0$ ) of no association is accepted [15].

### 3.2.1.2 Association between cane yield (Sugarcane variety CO-86032) and the land holding

It was found that there was no significant association between cane yield and land holding (Table 8). It implies that irrespective of size of land holding, the respondents had obtained same cane yield without much difference (chi square 2.67). The possible reasons could be that the small farmers might have intensively undertaken the sugarcane management practices with family labour. Where as the medium farmers they might

have not shown interest in intensive care and crop management, though they had affordable capacity for more inputs and machinery facilities. The alternate hypothesis ( $H_1$ ) of association between the cane yield and land holding size is rejected and the null hypothesis ( $H_0$ ) of no association is accepted.

### 3.2.1.3 Association between cane yield (sugarcane variety CO-86032) and education level

The study found that there was no significant association between cane yield and education level (Table 9). It implies that the literacy had not played a key role in enhancing the cane yield. Both illiterates and literate respondents had obtained same cane yield without much difference (chi square 6.86). The alternate hypothesis ( $H_1$ ) of association between the cane yield and education level is rejected and the null hypothesis ( $H_0$ ) of no association is accepted. The possible reasons could be that for cultivation of sugarcane it normally does not require much technical knowledge, except in the case of fertilizer and pesticide application. Here the genetic potentiality of the crop might have played a crucial role than that of respondents' education. The literate respondents might have used their educational knowledge in post-harvest handling and marketing activities of sugarcane rather than cultivation practices. The experience of the illiterate farmers might have also influenced to some extent [16].

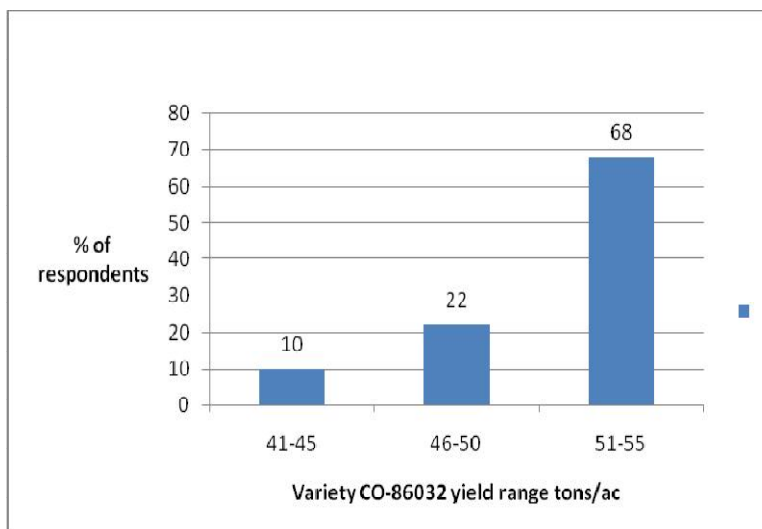


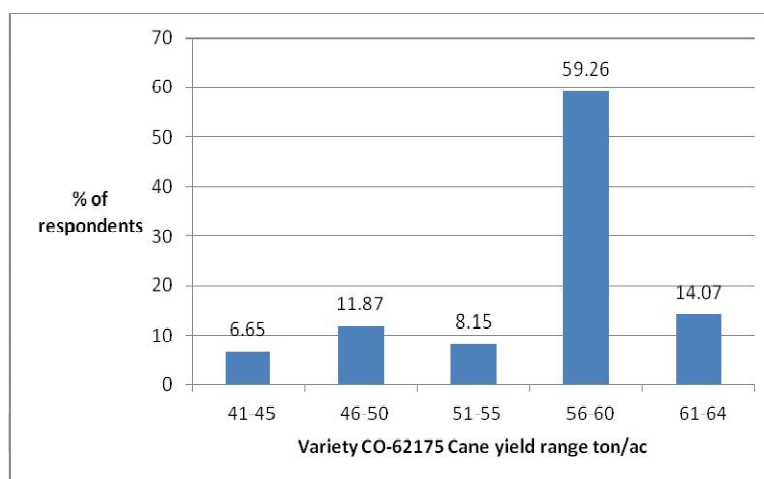
Fig. 3. Distribution of respondents cane yield (ton/ac) obtained from CO- 86032



**Table 4. Distribution of respondents according to cane yield obtained from CO-62175 variety**

Yield range (ton/ac)	Mandya		Maddur		Srirangapatna		Total	
	No	%	No	%	No	%	No	%
41-45	2	4.50	1	2.20	6	13.00	9	6.65
46-50	3	7.00	5	11.0	8	18.00	16	11.87
51-55	5	11.00	2	4.50	4	9.00	11	8.15
56-60	28	62.00	27	60.00	25	55.5	80	59.26
61-64	7	15.50	10	22.30	2	4.50	19	14.07
<b>Total</b>	<b>45</b>	<b>100.0</b>	<b>45</b>	<b>100.0</b>	<b>45</b>	<b>100.0</b>	<b>135</b>	<b>100.0</b>

(Minimum: 45.0 ton/ac Maximum: 64.0 ton/ac Average: 62.19 ton/ac)

**Fig. 4. Distribution of respondents cane yield (ton/ac) obtained from CO-62175****Table 5. Comparison of cane yield and income obtained from sugarcane varieties CO-86032 and CO-62175**

Parameters	n=270	
	Sugarcane var CO-86032 (n=135)	Sugarcane var CO-62175 (n=135)
Average cane yield (ton/ac)	51.91	62.00
Market price (Rs./ton)	1100.00	950.00
Average jaggery recovery (kg/ton)	120.00	95.00
Income (Rs./ac)	57101.00	58080.00
		Difference
		-10.09
		150.00
		25.00
		-979.00

**Table 6. Perceived reasons of respondents to adopt or discontinue the sugarcane variety CO-86032 in comparison with CO-62175**

Sl. no	Reasons for continued adoption	n=270	
		No	%
1	High sugar content in the cane	265	98.14
2	More price offered by the Jaggery units	177	65.55
3	Golden brown color Jaggery (consumer preference)	170	62.96
4	Early maturity (nearly 2 months)	140	51.85
<b>Reasons for discontinuance and limitations</b>			
1	Less yielder	215	79.62
2	Less tillering	167	61.85
3	Less ratooning ability	150	55.50
4	More input and management cost	125	46.29

Note: Multiple responses



**Table 7. Association between cane yield of variety CO-86032 and family size of respondents**

Family size (no)	Cane yield range (ton/ac)				n=135
	41-45	46-50	51-55	Total	Chi-square value
2-6	9 (6.66)	19 (14.07)	45(33.33)	<b>73 (54.67)</b>	<b>5.26 NS</b>
7-11	5 (3.70)	11 (8.14)	46 (34.07)	<b>62 (45.92)</b>	
<b>Total</b>	<b>14 (10.37)</b>	<b>30 (22.22)</b>	<b>91 (67.40)</b>	<b>135 (100)</b>	

NS: Non significant association; Figures in the parentheses indicate percentage

**Table 8. Association between cane yield of variety CO-86032 and land holding of the respondents**

Land holding (ha)	Cane yield range (ton/ac)				n=135
	41-45	46-50	51-55	Total	Chi-square value
<b>0.1 to 2.0</b>	8 (5.92)	14 (10.37)	40 (29.62)	<b>64 (47.40)</b>	<b>2.67 NS</b>
<b>2.0 to 4.0</b>	6 (4.44)	16 (11.85)	51 (37.77)	<b>71 (52.59)</b>	
<b>Total</b>	<b>14 (10.37)</b>	<b>30 (22.22)</b>	<b>91 (67.40)</b>	<b>135 (100)</b>	

NS: Non significant; Figures in the parentheses indicate percentage

**Table 9. Association between cane yield of variety CO-86032 and education level of respondents**

Education level	Cane yield range (ton/ac)				n=135
	41-45	46-50	51-55	Total	Chi-square value
<b>Illiterates</b>	5 (3.71)	8 (5.92)	14 (10.37)	<b>27 (20.00)</b>	<b>6.86 NS</b>
<b>Literates</b>	9 (6.66)	22 (16.27)	77 (57.07)	<b>108 (80.00)</b>	
<b>Total</b>	<b>14 (10.37)</b>	<b>30 (22.22)</b>	<b>91 (67.41)</b>	<b>135 (100)</b>	

NS: Non significant association; Figures in the parentheses indicate percentage

#### 4. CONCLUSION

The study was conducted in Mandya district during 2009-10 and was retested during 2016 on pilot sample to ascertain the impact and performance of farm university technologies among the farmers. The differences between cane yields of two sugarcane varieties were compared. It was found that the variety CO-62175 yielded 3.73 ton/ac more cane yield than that of CO-86032. Majority of the farmers harvested the yield ranging from 51-55 ton/ac. Similar yield trend was observed in all the three taluks of Mandya district. In case of CO-62175, majority of the farmers (85.5%) harvested the yield ranging from 56-60 ton/ac. Similar yield trend was observed in all the three taluks. Regarding, jaggery recovery and income, the farmers obtained 120 kg of jaggery per ton of cane crushed from CO-86032. Around 25 kg additional jaggery was recovered by crushing one ton cane compared with CO-62175. The reasons for adoption of CO-86032 variety, majority of the respondents expressed that the

Jaggery units offered higher price than that of Sugar factories. Higher recovery of quality jiggery, consumes preference because of its pleasant color, consumer preference and high market price. Further, it was found that there was no significant association between cane yield and with the selected social variables; the family size, land holding and education level of respondents. It implies that the literacy had not played a key role in enhancing the crop yields.

#### 5. RECOMMENDATIONS

The implications of the findings are, though the cane yield of CO-86032 is relatively less compared to CO-62175, the majority of the farmers were willing to continue adopt it, as it had multiple advantages, thus it should be promoted in large area in the Mandya and adjoining districts of Karnataka where similar agro climatic conditions exists. Further, there is a need to evolve new high yielding varieties retaining the some of the beneficial attributes of CO-86032. There is a need to find out the other

social, economic psychological, economic, cultural factors associated with cane yield, to bring out refinement in the technologies for its wider adoption to increase the cane yield and income of the farmers.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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