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Effect of cultivars and organic nutrient management practices on quality of liquid Jaggery (Joni Bella)

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Abstract
An experiment was conducted to study the effect of cultivars and organic nutrient management on quality of liquid Jaggery at Agriculture Research Station, Kumta, Uttara Kannada, Karnataka. The experiment consisted three main plots (Cultivars) *viz.,* C_1: SNK 635, C_2: Co 86032 and C_3: Konanakatte and seven sub plots (nutrient management practices) *viz.,* N_1: Farm Yard Manure (FYM) (1/3rd) + Vermicompost (VC) (1/3rd) + Biogas slurry (BGS)(1/3rd), N_2: FYM (1/3rd) + VC (1/3rd) + Biodigester filtrate (BDF) (1/3rd), N_3: FYM (50%) + VC (50%), N_4: FYM (50%) + BGS (50%), N_5: FYM (50%) + BDF (50%), N_6: Recommended package of practices (RPP) and N_7: Farmer's practice. The results indicated that, non- reducing sugar % was not significantly influenced by cultivars and nutrient management and their interactions. Whereas, reducing sugar content was significantly influenced by cultivars and nutrient management. The cultivar SNK 635 recorded significantly lower reducing sugars (13.16%). Other quality parameters like fat, protein, ash, moisture, colour and pH of liquid Jaggery were not significantly influenced by cultivars and organic treatments. EC values of liquid Jaggery was significantly influenced by cultivars. SNK 635 recorded significantly lower EC values (1.11 dSm^{-1}). Overall acceptability score point of SNK 635 liquid Jaggery was 8.25. Organic nutrient management had significantly higher overall acceptability score points.

Keywords: Liquid Jaggery, organic, quality, SNK 635, sugarcane

Introduction

Sugarcane is one of the major commercial crops of industrial importance. Globally sugarcane is cultivated on an area of 26.54 million hectares with a production of 1861 million tonnes and productivity of 70.13 tonnes ha^{-1} (Anonymous, 2019) [2], India is the second largest producer of sugarcane after Brazil. In India, sugarcane area under cultivation is 4.93 m ha, with production of 348.45 million tonnes and productivity of 70.70 t ha^{-1} (Anonymous, 2019) [2]. Karnataka state ranks 3rd position in both area (0.44 m ha) production (27.38 million tonnes) with the productivity of 68.96 t ha^{-1} (Anonymous, 2019) [2]. Though sugarcane is being utilized mainly for sugar production with enough number of sugar factories, nearly 40% of sugarcane is being diverted to Jaggery industry indicating its importance. Solid Jaggery, liquid Jaggery and granular Jaggery are the three types of Jaggery making in India. Liquid Jaggery is an intermediate product collected during Jaggery manufacturing with striking temperature ranges from 105 °C to 108 °C. It is widely used as sweetening agent in Karnataka, Maharashtra, Tamil Nadu, Gujarat, Andhra Pradesh and Kerala states. It is commercially used in various food industries and pharmaceutical formulations (Chikkappaiah, *et al*., 2017) [3]. In Uttara Kannada district of Karnataka, sugarcane is being grown only for preparation of liquid Jaggery which is known as "Joni bella". Farmers grow sugarcane on a small area and make liquid Jaggery for domestic use every year using local cultivar 'Konanakatte'. The quality liquid Jaggery depends on juice quality, soil type, cultivars, nutrient management and processing methods. Major problems associated with liquid Jaggery production are fermentation and saltiness of liquid Jaggery. Hence, trial was conducted on effect of cultivars and organic nutrient treatments on quality of liquid Jaggery. The objective of study was to find suitable cultivar and organic nutrient practices for quality liquid Jaggery production.

Materials and Methods

An experiment was conducted to study the effect of cultivars and nutrient management practices on quality of liquid Jaggery at Agriculture Research Station, Kumta, Uttara Kannada of University of Agricultural Sciences, Dharwad (Karnataka) during 2018-19 and 2019-20. Experimental site lies in Coastal zone of Karnataka (Zone-10) and Region II of Agro-climatic zones of India. The experimental site was located at 14° 25' North latitude and 74° 25' East longitude with an altitude of 24.2 m above the mean sea level. The district has high rainfall coming under malnad region. The average rainfall of the location for the past 23 years is 3722.28 mm, which is distributed over a period of six months from June to October month with peaks during June, July and August (999.7, 1088.1 and 775.7 mm, respectively). The soil of the experimental site was sandy loam, belonged to the order alluvial soils.

The experiment was planned with three main plots (Cultivars) and seven sub plots (Nutrient management practices). The treatments details are given below in detail.

Main Plots (Three Cultivars)

C_1: SNK 635
C_2: Co 86032
C_3: Konanakatte local cultivar

Sub plots (Seven nutrient management practices -NMPs)

N_1: Nutrient management practices through the application of 100% organics equivalent to recommended dose of nitrogen [1/3rd through FYM as basal + 1/3rd through Vermicomposting (VC) applied in two splits at 90 and 120 DAP + 1/3rd through Biogas slurry applied in eight splits at an interval of 15 days from 90 days to 120 and 180 to 240 days after planting (DAP) / days in ratoon (DIR)]

N_2: Nutrient management practices through addition of 100% organics equivalent to recommended dose of nitrogen [1/3rd through FYM as basal + 1/3rd through VC in two splits applied at 90 and 120 DAP +1/3rd through Bio-digester filtrate (BDF) applied in five splits at an interval of 15 days from 90 to 120 and 180 to 240 DAP/DIR,

N_3: Nutrient management practices through addition of 100% organics equivalent to recommended dose of nitrogen (50% through FYM as basal + 50% through VC at 90 and 120 DAP/DIR),

N_4: Nutrient management practices through addition of 100% organics equivalent to recommended dose of nitrogen (50% through FYM as basal + 50% through Biogas slurry in eight splits at an interval of 15 days from 90 days to 120 and 180 to 240 DAP/DIR),

N_5: Nutrient management practices through addition of 100% organics equivalent to recommended dose of nitrogen (50% through FYM as basal + 50% through the application of BDF in 10 splits from 90 to 120 and 180 to 240 DAP /DIR),

N_6: Recommended package of practices (RPP) and

N_7: Farmer's practice (1 ton of FYM @ 1.5 t ha $^{-1}$+ Forest litter).

The experiment was laid out in strip block design with three replications. The plot size was 7.2 m X 14.1 m. The single eye budded setts of 10 months old cane were planted in furrows on 23rd March, 2018 and crop was harvested after 365 days. The crop was harvested to the ground level and detrashed, bundled and stacked before recording the plot yield. A recommended dose of dolomite (500 kg ha^{-1}) during land preparation and farm yard manure (25 t ha^{-1}) were given. Nitrogen, phosphorus and potassium fertilizers were applied as per the treatments in the form of urea, rock phosphate and muriate of potash, respectively. As per the treatment, 25 kg of $ZnSO_4$ along with 250 kg of FYM was applied to soil before planting.

Details of Organic Nutrient Management Practices (For N_1 to N_5)

- The organic manures *viz.*, farmyard manure, vermicompost, Bio-digester extract and bio gas slurry were analysed for their nutrient content before application for making N equivalent nutrient application (Table 1).
- Nutrients were supplied through FYM, VC, Bio gas slurry and BDF as per the treatment equivalent to 100% N over the recommended dose of FYM (*i.e.* 25 tha^{-1}).
- Soil application of Phosphorus solubilizing bacteria (PSB) @ 10 kg ha^{-1} mixed with FYM (To augment P availability).
- Neem cake @ 250 kg ha^{-1} (As a bio insecticide)
- *Metarhizium anisopliae* @ 10 kg ha^{-1} by mixing with FYM (As a bio insecticide)
- *Gluconacetobacter* @ 4 lit ha^{-1} (for set treatment at planting)
- *Gluconacetobacter* used as foliar spray @ 5% at 30 DAP
- Panchagavya liquid organic manure used as foliar spray @ 3% at 60 and 90 DAP (as a source of nutrient and growth promoter)
- Spray of NSKE 0.5% (As a bio insecticide)

Details of RPP (recommended package of practices) for S_6

- FYM @ 25 t ha^{-1} applied in furrows before planting.
- Recommended dose of fertilizers: 186:125:125 kg N: P_2O_5: K_2O ha^{-1}
- Bio-fertilizers: *Azospirillium* and Phosphorus solubilizing bacteria (PSB) @ 10 kg ha^{-1} mixing through FYM.
- Soil application of $ZnSO_4$ @ 25 kg ha^{-1}.

Salient features of the cultivars

SNK 635: Parentage Co 8013 Poly cross, Midlate (11-12 months) with fast growth, high yielding, sugar rich variety superior over Co 86032, non-flowering with excellent field capacity, medium thick erect canes with dark green colour canopy, high tillering, suitable for high rainfall areas and lateritic /acid soils. It is suitable for solid Jaggery, liquid Jaggery (Joni Bella) and sugar production.

Co 86032

Parentage is Co 62198 x CoC 671, duration of 11 - 12 months, responds very well to all sources of nutrients, suitable for solid Jaggery, Sugar and liquid Jaggery (Joni bella) production. This variety is sweeter than Konanakatte local cultivar, high tillering, high yielding and quality cane variety with excellent ratooning ability, reddish pink (exposed) greenish yellow (unexposed) coloured medium thick canes with broad green root zone and green purple leaf sheath, self detrashing in nature, late and very sparse flowering (< 5%), hence longer field keeping quality.

Konanakatte: It is local mid late variety with duration of 11-12 months, cultivated by farmers of Uttara Kannada and Shimoga districts of Karnataka, soft cane with medium sweetness with higher moisture content, pinkish blue cane, suitable for liquid Jaggery production.

Table 1: Nutrient composition (%) of organic manures used in the experiment

Nutrient (percent)	FYM	VC	Bio-gas slurry	BDF
Nitrogen	0.65	1.24	1.12	1.05
Phosphorus	0.23	0.72	0.82	0.68
Potassium	0.68	0.95	0.96	0.64
Calcium	2.03	5.50	1.56	1.00
Magnesium	0.89	2.89	0.59	0.30
Zinc	0.009	0.012	0.018	0.016
Copper	0.006	0.04	0.03	0.01
Iron	0.192	0.35	0.3	0.26
Manganese	0.041	0.08	0.05	0.06
Sulphur	1.09	3.12	0.89	0.50

Liquid Jaggery preparation

The cane samples of net plot area from each treatment were used for liquid Jaggery preparation. All the treatment canes were processed organically and the Jaggery samples were stored for further observations.

Steps involved in Liquid Jaggery preparation

1. **Cane crushing:** After harvesting, cane samples of net plot area were crushed in horizontal three roller crusher having juice extraction efficiency of about 65%.
2. **Juice filtration:** The extracted juice was cleaned by using two stage filtration systems. Juice was passed through nylon cloth for filtration while transferring the juice from storage tank to the boiling pan.
3. **Juice boiling:** The extracted juice was taken to boiling pan for Jaggery processing. Dried cane bagasse was used as fuel for boiling. The pH of fresh juice ranged between 5.2 to 5.4 and raised to 6.5 by using lime (CaO_3). The neutral pH of juice facilitates the coagulation of suspended impurities of gummy colloidal substances. It also helps to avoid inversion of sugar. For this purpose, lime solution prepared by dissolving lime @ 150- 200 g in 5 litre of water was added to cane juice.
4. **Juice clarification:** The herbal clarificant like wild okra / Okra plant (*Abelmoschus esculentus)* stalk extract was used for clarification of juice. This extract was prepared by crushing 2 kg of okra plant stalk and soaking in 15 litre of water. The filtered extract was added to juice for clarification. At 85 °C temperature, the nitrogenous impurities in juice start to coagulate and float on surface as black scum which was removed by using strainer. Scum removal operation is very important operation in the Jaggery processing and efficiency of this operation decides the colour and quality of liquid Jaggery. Removal of second golden scum should be done during boiling as and when it appears on top of juice in the boiling pan.
5. **Juice concentration:** After clarification of juice, when temperature rises to about 99 °C to 100 °C, the juice begins to froth. Continuous stirring is done by specially fabricated churner to control excess frothing and to avoid loss of juice due to overflowing. Groundnut edible oil was mixed @ 200 ml /1000 litre of juice. After de-frothing, juice gets concentrated at 105 - 109 °C temperature. The liquid Jaggery stage is attained at this temperature. The electronic thermometer with one meter long sensor attached to the boiling pan is used for accurate recording of juice temperatures at different stages.
6. **Jaggery cooling and moulding:** When juice temperature rises to 105-109 °C, the liquid Jaggery stage is attained. This stage could be ascertained by Jaggery ball test (Jaggery will be appeared in boll form when dip in water). At this stage, immediately the boiling pan is removed from furnace and hot Jaggery is poured in cooling tray. During cooling, two stirrings are applied to hot Jaggery with wooden ladles. This stirring application helps to improve colour and granularity of liquid Jaggery. When the temperature of liquid Jaggery drops down to 34 °C, the cooled liquid Jaggery is taken in to aluminium cans.

Liquid Jaggery quality parameters

Liquid Jaggery samples were collected during processing and were analysed according to quality parameters.

Non-reducing sugar (Sucrose) % in liquid Jaggery

The sucrose content in 0.5 N solution of Jaggery samples *i.e.*, 13 g of Jaggery dissolved in 100 ml of water was determined polarimetrically as done for the sugarcane juice sucrose (Somogyi, 1952). The values so obtained were expressed in % Jaggery (undissolved) basis based on dilution factor.

$$\text{Sucrose \%} = \frac{\text{Sucrose content (\%) in 0.5 N solutions}}{13} \times 100$$

Reducing sugars (RS) % in liquid Jaggery

The reducing sugars were estimated by titrating the Jaggery solution (10 g dissolved in 100 ml of water and clarified with lead sub acetate of activated charcoal) with 10 ml of Fehlings A + B solution according to Lane and Eynon volumetric method (Miller, 1998).

$$\text{Reducing sugars \%} = \frac{0.05 \times \text{volume of jaggery solution (ml)}}{\text{T.V.} \times \text{Weight of jaggery (g)}} \times 100$$

Where,
T.V. is the titrable value

Ash % in liquid Jaggery

The minerals originally present in the cane juice as well as additions during the preparation of Jaggery constitute the ash which in excess affects the taste and refining quality of Jaggery. The ash content in Jaggery samples were estimated by igniting 5 g of Jaggery in silica crucibles over a burner and then ashing them in muffle furnace at 500 °C and recording the ash weight. The ash contents were expressed on % Jaggery basis as indicated below.

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of jaggery sample}} \times 100$$

Weight of Jaggery sample

Protein content in liquid Jaggery

For the digestion of samples, the Pelican digestion unit was used. The distillation was carried out in Gerhardt nitrogen distillation. The protein content of the dried sample was estimated as % total nitrogen by the Micro-kjeldahl method (Anonymous, 1980) [1] and computed by multiplying the % nitrogen using conversion factor 6.25.

Fat content in liquid Jaggery
Fat was estimated as crude ether extract of the dry material. The dry sample was weighed (10 g) accurately into a thimble and plugged with cotton. The thimble was then placed in a Soxhlet apparatus and extracted with anhydrous ether for about 3 hours, then evaporated and the flask with the residue was dried in an oven at 80-100 °C, cooled in a desiccator and weighed (Anonymous, 1980) [1].

Moisture content (%)in liquid Jaggery
Jaggery (5 g) with few drops of absolute alcohol was dried to constant weight at 70 °C in a hot-air oven (Mandal *et al.*, 2006) [12].

Liquid Jaggery pH (1:1) and EC
Jaggery pH was determined by using pH meter (Adwa AD1020). Ten grams of sample was blended with 10 ml of distilled water and the pH of the suspension was determined by dipping the electrode in the suspension (Khan *et al.*, 2014) [9]. The Electrical conductivity of liquid Jaggery was measured by using conductivity meter (Systronics Conductivity meter 306).

Colour of the Jaggery
Using colorimeter, the percentage transmittance of 0.5 N solution of Jaggery was recorded at 540 nm (Mandal *et al.*, 2006) [12].

Organoleptic evaluation of Jaggery samples
Jaggery samples were evaluated for organoleptic characteristics *viz.*, colour, texture, taste, flavour and overall acceptability by scoring method using nine point hedonic scale by a 10 Jaggery technicians.

Nine point hedonic scale

Scale	Grade
9	Like extremely
8	Like very much
7	Like moderately
6	Likely slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

Results and Discussion

Non-reducing sugars (cf. Table 2 and 3)
Non-reducing sugars (Sucrose) is an important content in the liquid Jaggery to improve the keeping quality and to fetch higher market price. The Jaggery containing above 65% sucrose is considered as good quality for human consumption (Kale and Chinchorkar, 1964) [8]. In the study it was indicated that the non-reducing sugar content was not significantly influenced by cultivars, nutrient management practices and their interactions in both plant and ratoon cane liquid Jaggery. However, SNK 635 recorded higher non reducing sugar (75.89%) followed by Co-86032 (73.66%) in plant cane liquid Jaggery. Whereas, Konanakatte cultivar had lowest non reducing sugar (72.12%). Among nutrient management practices, lowest non reducing sugar was recorded with RPP treatment (71.94%). In organic nutrient management treatments, non-reducing sugars ranged from 73.68 to 74.91%. Interactions of cultivars and organic nutrient practices showed that, the non-reducing sugar percent ranged from 75.46 to 76.90% in plant cane liquid Jaggery. Similar results were obtained in liquid Jaggery of ratoon cane also. Nooli (2019) [15] recorded higher amounts of non-reducing sugars with application of 100% organics (N_1 to N_5) compared to RPP. However, RPP and organic NMPs (N_1 to N_5) were on par with each other. Kuri (2014) [10] also reported that with application of FYM + VC + Enriched Press mud @ 1/3 each improved the quality of Jaggery. Among the organic treatments, Jaggery quality parameters were on par with each other in plant and ratoon cane Jaggery.

Reducing sugars (cf. Table 2 and 3)
Cultivars, nutrient management practices and their interactions had significant influence on reducing sugars in both plant and ratoon cane liquid Jaggery. The cultivar SNK 635 recorded lower reducing sugar (13.16%) followed by Co-86032 (14.10%). Whereas, Konanakatte cultivar had significantly higher reducing sugar (14.30%) but on par with Co 86032 cultivar in plant cane liquid Jaggery. Among nutrient management practices, significantly higher reducing sugar was recorded with RPP treatment (15.11%). Reducing sugars content in organic nutrient management practices found on par with each other and ranges from 13.24 to 13.99%. In the interaction effect, cultivar SNK 635 with organic treatment FYM (50%) + biogas slurry (50%) (C_1N_4) recorded significantly lower reducing sugar (12.74%) than C_2N_6 (15.46%) and C_3N_6 (15.34%) but on par with all other interactions. Significantly higher reducing sugar % was recorded with Co-86032 (C_2N_6) (15.46%) and Konanakatte (C_3N_6) (15.34%) with RPP treatment. Similar results were obtained in ratoon cane liquid Jaggery also. Nooli (2019) [15] recorded higher amounts of reducing sugar with application of 100% organics compared to RPP.

Fat content in Jaggery (cf. Table 2 and 3)
The effect of treatments on fat content was non-significant due to the influence of cultivars, nutrient management practices and their interactions in both plant and ratoon cane liquid Jaggery. However, it ranged from 0.146 to 0.197% and 0.146 to 0.201%, respectively in plant and ratoon cane liquid Jaggery. The similar results were obtained by Nooli (2019) [15].

Protein content (cf. Table 2 and 3)
Protein content in liquid Jaggery also followed the similar trend of fat content. Cultivars, nutrient management practices and their interactions did not influence on protein content in liquid Jaggery of both plant and ratoon cane. However, protein content in nutrient management practices interactions had 0.443 to 499% and 0.456 to 0.499%, respectively in plant and ratoon cane liquid Jaggery. The study conducted by Nooli (2019) [15] revealed that the Jaggery produced from cultivar SNK 07690 contains higher protein in plant cane Jaggery (0.473%) and ratoon cane Jaggery (0.449%) than SNK 09211.

Ash content in liquid Jaggery (cf. Table 4 and 5)
Ash content in plant and ratoon cane liquid Jaggery was not influenced by cultivars. In plant cane liquid Jaggery, the lower ash content was recorded with SNK 635 (1.992%) and Co 86032 (1.991%) and higher ash content in Konanakatte (2.135%). Ash content in all three cultivars were below critical limit. The results are in line with the findings of

Usha *et al.* (2004) [18] who revealed that the ash content in the standard Jaggery should not exceed 5%. The presence of ash in the Jaggery over and above 5% affects adversely the taste of Jaggery and also refining quality. However, the ash content in tested cultivars Jaggery samples recorded lesser values than the critical limits due to organic (chemical free) processing methods adopted in the present study. Nutrient management practices had significant influence on ash content in both plant an ratoon cane liquid Jaggery. Among nutrient management treatments, significantly lower ash content was recorded in N_4 (FYM 50% + Biogas slurry 50%) (1.901%) than N_6 (RPP treatment) (2.407%) but on par with other organic treatments (N_1, N_2, N_3, N_5 and farmers practice). Ash content was not significantly influenced by interaction effect of cultivars and nutrient management practices. However, ash content ranged from 1.911 to 2.440% in plant cane liquid Jaggery. In ratoon cane liquid Jaggery also, similar data was reported as that of plant cane liquid Jaggery with respect to ash content.

Moisture % and colour (absorbance value) of liquid Jaggery (cf. Table 4 and 5)

The moisture content and colour of plant and ratoon cane liquid Jaggery were not significantly influenced by treatments. However, the moisture content ranged from 18.98 to 20.12% and 18.97 to 20.19%, respectively in plant and ratoon cane liquid Jaggery. Whereas, colour (absorbance value) from 0.421 to 0.454 and 0.424 to 0.454, respectively in plant and ratoon cane liquid Jaggery in interactions of nutrient management practices and cultivars.

Liquid Jaggery pH and EC (cf. Table 6)

The cultivars, nutrient management practices and their interaction did not influence the pH of liquid Jaggery of both plant and ratoon cane liquid Jaggery. However, pH values were ranges from 6.04 to 6.33 and 6.05 to 6.27, respectively in plant and ratoon cane liquid Jaggery in interaction of nutrient management practices and cultivars. Non significant results in pH values was due to addition of lime to juice for pH adjustment during processing of Jaggery. Similar on par results for pH values of Jaggery was reported by Nooli (2019) [15].

Electrical conductivity (EC) of liquid Jaggery differed significantly due to cultivars. Among cultivars, SNK 635 recorded significantly lower EC value (1.11 dSm^{-1}) than Co 86032 (5.03 dSm^{-1}) and Konanakatte cultivar (10.42 dSm^{-1}). Significantly higher EC value was recorded in cultivar Konanakatte (10.42 dSm^{-1}) in plant cane. Lower EC in SNK 635 due to lesser mineral salts content in liquid Jaggery. In ratoon cane liquid Jaggery also followed same trend as that of plant cane liquid Jaggery. This differential EC in liquid Jaggery of cultivars might be due to differential salt exclusive mechanism in cultivars. SNK 635 might have expressed salt exclusive mechanism and hence absorbed lesser mineral salt that leads to lesser EC than other two cultivars. This in conformity with findings of Medina and Ernesto (2013) [13] who had differential uptake mechanisms in different genotypes. Howyzeh *et al.* (2008) [6] also obtained result that CP82 1592 had minimum transport of Cl- to shoots with lowest ratio of shoot / root chloride. This cultivar had high content of Ca_2+ in shoot and low Na^+/Ca^{2+} ratio. CP48 103 recorded low sodium in shoots and relatively low sodium in roots. Thus it probably had genetic potential to avoid sodium uptake. Exclusion of Na+ and Cl- to older leaves and tillers was observed in CP82 1592 and CP72 2086 cultivars. According to research results, absorption, transportation and exclusion of harmful Na+ and Cl- ions were the mechanisms in genotypes in salinity tolerance of sugarcane. Nutrient management practices and interaction effect of cultivars and nutrient management practices did not influence EC values in liquid Jaggery of both plant and ratoon cane. In interactions, EC values ranged from 1.01 to 10.66 dSm^{-1} and 1.07 to 10.63 dSm^{-1}, respectively in liquid Jaggery of both plant and ratoon cane.

Organoleptic character of liquid Jaggery (cf. Table 7 and 8)

Cultivars, nutrient management practices and interactions of cultivars and nutrient management practices had significant influence on organoleptic characteristics of liquid Jaggery produced in plant and ratoon cane.

Colour of liquid Jaggery (cf. Table 7 and 8)

Appearance is main factor influencing consumer acceptance and market price. Honey colour or golden yellow mixed red colour is preferred colour for liquid Jaggery. Colour of liquid Jaggery of both plant and ratoon cane were significantly influenced by cultivars. In plant cane liquid Jaggery, the cultivar Co 86032 recorded significantly higher point (7.84) compared to Konanakatte (6.46) but on par with point scored in SNK 635 (7.68). Cultivar Konanakatte scored lowest point (6.46). The cultivar Co 86032 had honey colour than other two cultivars. Whereas, SNK 635 had darker colour than CO 86032 and light colour than Konanakatte. Guddadamath *et al.* (2014) [5] also reported similar differential colour in different genotypes. Nutrient management practices had significant influence on colour of liquid Jaggery of plant. Among nutrient management practices, organic treatments recorded higher score than RPP treatment. Treatment N_4 (FYM 50% + Biogas slurry 50%) recorded significantly higher score point (7.58) than RPP treatment (6.74) but on par with other organic treatments. Whereas, N_6 (RPP treatment) recorded score point on par with all organic treatment except N_4. Interaction effect was also found to be significant on colour of liquid Jaggery. Among interactions, C_2N_4 (Co 86032 with FYM 50% + Biogas slurry 50%) recorded higher score point (8.24) and found on par with interactions from C_1N_1 to C_2N_7. Lower score point for colour of liquid Jaggery was recorded with Konanakatte cultivar in all nutrient management practices (C_3N_1 to C_3N_7). Similar trend of plant cane liquid Jaggery was obtained in ratoon cane liquid Jaggery for colour.

Texture of liquid Jaggery (cf. Table 7 and 8)

In liquid Jaggery, texture is also an important parameter for consumer preference. Free flowing and finer texture character is preferred for better market. Thinner and honey like liquid in top and thicker liquid at bottom of container is also preferred. Different cultivars, nutrient management practices and interactions were influenced significantly the texture of liquid Jaggery produced from both plant and ratoon cane. Among cultivars, SNK 635 scored significantly higher score point (8.51) compared to Co 86032 (6.84) and Konanakatte (6.48). Cultivar Co 86032 and Konanakatte recorded on par score point. Konanakatte scored lowest point for texture. SNK 635 cultivar had honey like free flowing finer texture quality whereas, Co 86032 had honey like thinner liquid at top and thicker at bottom of container hence both cultivar had on par score points. Nutrient management treatments had significant influence on texture of liquid Jaggery. Among all nutrient treatments, organic treatments and farmers practice had significantly higher score point compared to RPP treatment. In interactions also, score point for texture differed significantly. In interactions of plant cane liquid Jaggery, significantly higher score point was obtained in C_1N_4 (SNK 635 with FYM 50% + Biogas slurry 50%) (8.74) and found to be on par with all nutrient treatment of SNK 635 cultivar. Whereas, C_3N_6 (Konanakatte with RPP treatment) recorded lowest value (5.96) and on par with all nutrient treatment of Co 86032 and Konanakatte cultivars (C_2N_1 to C_3N_7). Interactions in ratoon cane liquid Jaggery also similar results were reported.

Taste and flavour of liquid Jaggery (cf. Table 7 and 8)

Taste and flavour of liquid Jaggery produced from plant and ratoon cane was significantly influenced by cultivars, nutrient management practices and their interactions. In plant cane liquid Jaggery, among cultivars, SNK 635 scored significantly higher point (8.57) than Co 86032 (7.64) and Konanakatte (6.22). Significantly lower score point for taste and flavour was recorded in Konanakatte cultivar (6.22). Higher content of non-reducing sugars is the main reason for sweetness and hence scored higher score point for taste and flavour in SNK 635 cultivar. Whereas, Konanakatte had lower non-reducing sugars hence lesser taste and scored lower points. Again Konanakatte recorded higher EC due to higher mineral salts than other two cultivars. This brought saltiness in liquid Jaggery of Konanakatte than SNK 635 and Co 86032. Fogliata and Aso (1965) [4] reported that an increase in soluble salts in the soil caused a consequent accumulation of salts in the cane juice which affects the taste of Jaggery. Different nutrient management practices had significant influence on taste and flavour of liquid Jaggery of plant and ratoon cane. All organic nutrient management practice treatments recorded significantly higher score point than RPP treatment. The highest score was recorded in N_4 (FYM 50% + Biogas slurry 50%) (7.76) and found on par with other organic treatments. Lowest value was recorded in RPP treatment (6.72). Since, in RPP treatment, nutrients were supplied with chemical fertilizers affected the taste. Especially, potassium nutrient was supplied through muriate of potash (Potassium chloride) this leads to increased salt content in liquid Jaggery and caused saltiness of liquid Jaggery. Saltiness in liquid Jaggery is least preferred by consumers and fetches lesser price in market. In interactions of cultivar and nutrient management practices, significantly higher score points were registered for all organic treatments of SNK 635 cultivar and Lower points were reported for RPP treatment of Co 86032 and all treatments of Konanakatte cultivar. Same trend of results were registered for taste and flavour in ratoon cane liquid Jaggery also.

Over all acceptability of liquid Jaggery (cf. Table 7 and 8)

With respect to overall acceptability, cultivars, nutrient management practices and their interactions were found to have significant influence on over all acceptability for both plant and ratoon cane liquid Jaggery. Among cultivars, SNK 635 scored significantly higher point (8.25) than Co 86032 (7.44) and Konanakatte (6.39) in plant cane liquid Jaggery. Significantly lower score point for overall acceptability for liquid Jaggery was recorded in Konanakatte cultivar (6.39). Nutrient management practices had significant influence on over all acceptability of liquid Jaggery of plant and ratoon cane. Organic nutrient management practice treatments (N_1 to N_5) recorded significantly higher score point (7.56, 7.52, 7.55, 7.60 and 7.50, respectively) than RPP (N_6) (6.72) and farmer practice (N_7) (7.07) treatment for overall acceptability for liquid jagger of plant cane. The highest score was recorded in N_4 (FYM 50% + Biogas slurry 50%) (7.60) in plant cane liquid Jaggery and found on par with other organic treatments. Lowest value was recorded in RPP treatment (6.72) and farmers practice treatment (7.07). Saini *et al.* (2006) [16] reported improved quality parameters of sugarcane with combined application of Press Mud Compost @ 10 t ha $^{-1}$ and bio- fertilizers than NPK alone. Kuri and Chandrashekar (2015) [11] also noticed that with application of FYM + VC + Enriched Press Mud @ 1/3 each improved the quality of Jaggery. Among the organic treatments, Jaggery quality parameters were on par with each other in plant and ratoon cane Jaggery. In interactions of cultivars and nutrient management practices, significantly higher score points were registered for all organic treatments of SNK 635 cultivar and Lower points were reported for RPP treatment of Co 86032 and all treatments of Konanakatte cultivar. Same trend was reported for liquid Jaggery of ratoon cane also for overall acceptability.

Table 2: Quality parameters of liquid Jaggery of plant cane as influenced by nutrient management practices and cultivars

Vertical strips [Nutrient management practice (NMP)]		Parameters															
		Non-reducing sugars (%)				Reducing sugars (%)				Fat (%)				Protein (%)			
		Horizontal strips (Cultivars)															
		C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean
N_1	FYM (33%) + VC (33%) + BGS (33%)	76.42	73.22	73.12	74.25	12.87	13.59	13.84	13.43	0.196	0.187	0.189	0.191	0.455	0.483	0.460	0.466
N_2	FYM (33%) + VC (33%) + BDF (33%)	76.13	73.81	72.78	74.24	13.08	14.02	14.16	13.75	0.189	0.184	0.186	0.186	0.446	0.479	0.454	0.460
N_3	FYM (50%) + VC (50%)	76.22	73.88	72.70	74.27	12.94	13.92	14.14	13.67	0.186	0.186	0.187	0.187	0.453	0.480	0.456	0.463
N_4	FYM (33%) + BGS (50%)	76.68	74.48	73.58	74.91	12.74	13.18	13.79	13.24	0.197	0.188	0.192	0.192	0.463	0.487	0.464	0.471
N_5	FYM (50%) + BDF (50%)	76.07	74.13	71.63	73.94	12.96	14.08	14.38	13.81	0.188	0.182	0.186	0.185	0.446	0.473	0.454	0.458
N_6	Recommended package of practices (RPP)	74.36	71.76	69.70	71.94	14.53	15.46	15.34	15.11	0.19	0.182	0.167	0.179	0.472	0.499	0.471	0.481
N_7	Farmers' Practice	75.35	74.34	71.35	73.68	13.01	14.47	14.47	13.99	0.187	0.179	0.146	0.171	0.443	0.464	0.450	0.452
	Mean	75.89	73.66	72.12		13.16	14.10	14.30		0.19	0.184	0.179		0.454	0.481	0.458	
		S.Em±		CD @ 0.05		S.Em±		CD @ 0.05		S.Em±		CD @ 0.05		S.Em±		CD @ 0.05	
Cultivars (C)		1.88		NS		0.22		0.85		0.011		NS		0.017		NS	
Nutrient management practices (NMP)		1.97		NS		0.53		1.64		0.010		NS		0.025		NS	
Cultivars at same level of Nutrient management		3.73		NS		0.74		1.85		0.018		NS		0.044		NS	
Cultivars at same or different level of Nutrient management		3.46		NS		0.82		1.96		0.016		NS		0.044		NS	

FYM - Farm Yard Manure VC – Vermicompost BGS-Biogas slurry BDF - Biodigester filtrate

C_1 - SNK 635 C_2 – CO 86032 C_3- Konanakatte

Table 3: Quality parameters of liquid Jaggery of ratoon cane as influenced by organic, integrated nutrient management practices and cultivars

Vertical strips [Nutrient management practice (NMP)]		parameters															
		Non-reducing sugars (%)				Reducing sugars (%)				Fat (%)				Protein (%)			
		Horizontal strips (Cultivars)															
		C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean
N1	FYM (33%) + VC (33%) + BGS (33%)	75.18	73.75	72.98	73.97	10.70	10.62	12.96	11.43	0.181	0.196	0.186	0.188	0.462	0.480	0.470	0.471
N2	FYM (33%) + VC (33%) + BDF (33%)	74.90	73.68	72.61	73.73	10.89	11.12	13.17	11.72	0.183	0.190	0.183	0.185	0.453	0.476	0.460	0.463
N3	FYM (50%) + VC (50%)	74.98	73.88	72.72	73.86	10.89	11.02	13.04	11.65	0.185	0.186	0.180	0.184	0.459	0.480	0.466	0.468
N4	FYM (33%) + BGS (50%)	75.44	74.28	73.41	74.38	10.58	10.25	12.83	11.22	0.178	0.201	0.185	0.188	0.473	0.487	0.470	0.477
N5	FYM (50%) + BDF (50%)	74.87	74.13	71.53	73.51	11.27	11.17	13.17	11.87	0.182	0.188	0.183	0.184	0.456	0.470	0.468	0.464
N6	Recommended package of practices (RPP)	73.13	71.76	69.60	71.50	12.20	12.49	14.62	13.10	0.182	0.190	0.167	0.179	0.479	0.499	0.474	0.484
N7	Farmers' Practice	74.15	72.34	71.28	72.59	11.30	11.57	13.25	12.04	0.179	0.184	0.146	0.170	0.456	0.464	0.460	0.460
	Mean	74.67	73.40	72.02		11.12	11.18	13.29		0.181	0.191	0.176		0.462	0.479	0.467	
		S.Em±		CD @ 0.05		S.Em±	CD @ 0.05			S.Em±		CD @ 0.05		S.Em±		CD @ 0.05	
Cultivars (C)		1.58		NS		0.43	1.67			0.010		NS		0.024		NS	
Nutrient management practices (NMP)		2.43		NS		0.72	NS			0.011		NS		0.028		NS	
Cultivars at same level of Nutrient management		3.66		NS		0.88	NS			0.018		NS		0.049		NS	
Cultivars at same or different level of Nutrient management		3.79		NS		0.99	NS			0.017		NS		0.047		NS	

FYM - Farm Yard Manure VC – Vermicompost BGS-Biogas slurry BDF - Biodigester filtrate
C_1 - SNK 635 C_2 – CO 86032 C_3- Konanakatte

Table 4: Quality parameters of liquid Jaggery of the plant cane as influenced by organic, integrated nutrient management practices and cultivars

Vertical strips [Nutrient management practice (NMP)]		Parameters											
		Ash (%)				Moisture (%)				Colour (absorbance value)			
		Horizontal strips (Cultivars)											
		C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean
N1	FYM (33%) + VC (33%) + BGS (33%)	1.911	1.885	1.958	1.918	19.22	19.38	19.95	19.52	0.430	0.452	0.430	0.437
N2	FYM (33%) + VC (33%) + BDF (33%)	1.916	1.888	2.102	1.969	19.17	19.20	19.73	19.37	0.429	0.451	0.430	0.436
N3	FYM (50%) + VC (50%)	1.915	1.886	2.015	1.938	19.21	19.22	19.95	19.46	0.429	0.451	0.430	0.436
N4	FYM (33%) + BGS (50%)	1.911	1.882	1.910	1.901	19.31	19.473	20.12	19.63	0.434	0.454	0.431	0.440
N5	FYM (50%) + BDF (50%)	1.919	1.992	2.206	2.039	19.15	19.37	19.63	19.38	0.428	0.450	0.429	0.436
N6	Recommended package of practices (RPP)	2.391	2.390	2.440	2.407	19.10	19.18	19.62	19.30	0.426	0.445	0.427	0.432
N7	Farmers' Practice	1.978	2.017	2.316	2.104	18.98	19.11	19.51	19.20	0.421	0.443	0.423	0.429
	Mean	1.992	1.991	2.135		19.16	19.28	19.79		0.428	0.449	0.428	
		S.Em±		CD @ 0.05		S.Em±		CD @ 0.05		S.Em±		CD @ 0.05	
Cultivars (C)		0.070		NS		1.09		NS		0.016		NS	
Nutrient management practices (NMP)		0.089		0.273		1.63		NS		0.027		NS	
Cultivars at same level of Nutrient management		0.163		NS		1.45		NS		0.055		NS	
Cultivars at same or different level of Nutrient management		0.157		NS		1.83		NS		0.054		NS	

FYM - Farm Yard Manure VC – Vermicompost BGS-Biogas slurry BDF - Biodigester filtrate
C_1 - SNK 635 C_2 – CO 86032 C_3- Konanakatte

Table 5: Quality parameters of liquid Jaggery of the ratoon cane as influenced by organic, integrated nutrient management practices and cultivars

Vertical strips [Nutrient management practice (NMP)]		Parameters											
		Ash (%)				Moisture (%)				Colour (absorbance value)			
		Horizontal strips (Cultivars)											
		C1	C2	C3	Mean	C1	C2	C3	Mean	C1	C2	C3	Mean
N1	FYM (33%) + VC (33%) + BGS (33%)	1.908	1.882	1.956	1.916	19.32	19.32	20.05	19.56	0.436	0.452	0.431	0.440
N2	FYM (33%) + VC (33%) + BDF (33%)	1.914	1.886	2.100	1.967	19.31	19.20	19.80	19.43	0.435	0.452	0.431	0.439
N3	FYM (50%) + VC (50%)	1.913	1.883	2.012	1.936	19.32	19.23	20.05	19.54	0.435	0.452	0.431	0.439
N4	FYM (33%) + BGS (50%)	1.911	1.880	1.908	1.900	19.47	19.49	20.19	19.72	0.441	0.454	0.432	0.442
N5	FYM (50%) + BDF (50%)	1.917	1.990	2.203	2.037	19.19	19.17	19.63	19.33	0.435	0.450	0.430	0.438
N6	Recommended package of practices (RPP)	2.368	2.387	2.437	2.398	19.17	19.04	19.55	19.25	0.433	0.444	0.427	0.434
N7	Farmers' Practice	1.978	2.015	2.314	2.102	18.97	19.18	19.55	19.23	0.428	0.443	0.424	0.432
	Mean	1.987	1.989	2.133		19.25	19.23	19.83		0.435	0.450	0.431	
		S.Em±		CD @ 0.05		S.Em±	CD @ 0.05			S.Em±		CD @ 0.05	
Cultivars (C)		0.066		0.261		1.08	NS			0.016		NS	
Nutrient management practices (NMP)		0.092		0.284		1.63	NS			0.027		NS	
Cultivars at same level of Nutrient management		0.161		NS		1.42	NS			0.056		NS	
Cultivars at same or different level of Nutrient management		0.159		NS		1.83	NS			0.054		NS	

FYM - Farm Yard Manure VC – Vermicompost BGS-Biogas slurry BDF - Biodigester filtrate
C_1 - SNK 635 C_2 – CO 86032 C_3-Konanakatte

Table 6: Liquid Jaggery pH and EC in plant cane as influenced by organic, integrated nutrient management practices and cultivars

Vertical strips [Nutrient management practice (NMP)]		Chemical properties															
		Plant cane								Ratoon cane							
		pH				EC (dS m^{-1})				pH				EC			
		Horizontal strips (Cultivars)															
		C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean
N_1	FYM (33%) + VC (33%) + BGS (33%)	6.31	6.26	6.24	6.27	1.08	5.01	10.23	5.44	6.24	6.20	6.18	6.21	1.15	5.08	10.29	5.51
N_2	FYM (33%) + VC (33%) + BDF (33%)	6.29	6.26	6.09	6.21	1.12	5.05	10.42	5.53	6.22	6.20	6.03	6.15	1.19	5.11	10.42	5.57
N_3	FYM (50%) + VC (50%)	6.30	6.22	6.24	6.26	1.12	5.04	10.32	5.49	6.24	6.16	6.17	6.19	1.18	5.11	10.36	5.55
N_4	FYM (33%) + BGS ((50%)	6.33	6.27	6.20	6.27	1.01	4.86	10.15	5.34	6.27	6.20	6.13	6.20	1.07	4.93	10.22	5.41
N_5	FYM (50%) + BDF (50%)	6.29	6.25	6.15	6.23	1.14	5.07	10.61	5.61	6.22	6.18	6.08	6.16	1.20	5.14	10.61	5.65
N_6	Recommended package of practices (RPP)	6.22	6.19	6.04	6.15	1.15	5.09	10.66	5.63	6.15	6.12	5.97	6.08	1.21	5.16	10.59	5.65
N_7	Farmers' Practice	6.16	6.17	6.08	6.14	1.14	5.07	10.56	5.59	6.09	6.10	6.05	6.08	1.21	5.14	10.63	5.66
	Mean	6.27	6.23	6.15		1.11	5.03	10.42		6.20	6.17	6.09		1.17	5.09	10.45	
		S.Em±	CD @ 0.05			S.Em±	CD @ 0.05			S.Em±	CD @ 0.05			S.Em±	CD @ 0.05		
Cultivars (C)		0.22	NS			0.26	1.01			0.26	NS			0.26	1.00		
Nutrient management practices (NMP)		0.32	NS			0.32	NS			0.35	NS			0.31	NS		
Cultivars at same level of Nutrient management		0.46	NS			0.66	NS			0.49	NS			0.60	NS		
Cultivars at same or different level of Nutrient management		0.48	NS			0.62	NS			0.51	NS			0.57	NS		

FYM - Farm Yard Manure VC – Vermicompost BGS-Biogas slurry BDF - Biodigester filtrate
C_1 - SNK 635 C_2 – CO 86032 C_3- Konanakatte

Table 7: Organoleptic characteristics of liquid Jaggery plant cane as influenced by organic, integrated nutrient management practices and cultivars

Vertical strips [Nutrient management practice (NMP)]		Organoleptic characteristics															
		Colour				Texture				Taste and flavour				Overall acceptability			
		Horizontal strips (Cultivars)															
		C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean
N_1	FYM (33%) + VC (33%) + BGS (33%)	7.85	8.20	6.55	7.53	8.733	6.963	6.570	7.422	8.90	7.92	6.38	7.73	8.49	7.69	6.50	7.56
N_2	FYM (33%) + VC (33%) + BDF (33%)	7.83	8.16	6.52	7.50	8.707	6.927	6.547	7.393	8.77	7.86	6.34	7.66	8.44	7.65	6.47	7.52
N_3	FYM (50%) + VC (50%)	7.83	8.19	6.53	7.52	8.707	6.960	6.570	7.412	8.88	7.90	6.37	7.72	8.47	7.68	6.49	7.55
N_4	FYM (33%) + BGS (50%)	7.93	8.24	6.58	7.58	8.743	6.997	6.613	7.451	8.94	7.93	6.41	7.76	8.54	7.72	6.53	7.60
N_5	FYM (50%) + BDF (50%)	7.80	8.13	6.52	7.48	8.673	6.903	6.537	7.371	8.82	7.85	6.31	7.66	8.43	7.63	6.45	7.50
N_6	Recommended package of practices (RPP)	7.29	7.20	6.33	6.94	7.733	6.357	5.957	6.682	7.43	6.67	5.56	6.55	7.48	6.74	5.95	6.72
N_7	Farmers' Practice	7.27	6.73	6.21	6.74	8.290	6.760	6.547	7.199	8.21	7.40	6.18	7.26	7.92	6.96	6.31	7.07
	Mean	7.68	7.84	6.46		8.512	6.838	6.477		8.57	7.64	6.22		8.25	7.44	6.39	
		S.Em±	CD @ 0.05			S.Em±	CD @ 0.05			S.Em±	CD @ 0.05			S.Em±	CD @ 0.05		
Cultivars (C)		0.18	0.72			0.20	0.77			0.18	0.71			0.20	0.78		
Nutrient management practices (NMP)		0.27	0.82			0.23	0.69			0.22	0.68			0.13	0.41		
Cultivars at same level of Nutrient management		0.57	NS			0.472	1.31			0.37	0.92			0.27	0.78		
Cultivars at same or different level of Nutrient management		0.55	1.67			0.44	1.22			0.36	0.88			0.26	0.67		

FYM - Farm Yard Manure VC – Vermicompost BGS-Biogas slurry BDF - Biodigester filtrate
C_1 - SNK 635 C_2 – CO 86032 C_3- Konanakatte

Table 8: Organoleptic characteristic of ratoon cane liquid Jaggery as influenced by organic, integrated nutrient management practices and cultivars

Vertical strips [Nutrient management practice (NMP)]		Organoleptic characteristics															
		Colour				Texture				Taste and flavour				Overall acceptability			
		Horizontal strips (Cultivars)															
		C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean	C_1	C_2	C_3	Mean
N_1	FYM (33%) + VC (33%) + BGS (33%)	7.95	8.14	6.95	7.68	8.95	7.75	7.60	8.10	8.90	7.92	6.35	7.72	8.60	7.93	6.97	7.83
N_2	FYM (33%) + VC (33%) + BDF (33%)	7.86	8.08	6.95	7.63	8.94	7.71	7.58	8.08	9.00	7.86	6.28	7.71	8.60	7.88	6.94	7.81
N_3	FYM (50%) + VC (50%)	7.86	8.09	6.96	7.64	8.91	7.75	7.60	8.09	9.05	7.86	6.27	7.73	8.61	7.90	6.94	7.82
N_4	FYM (33%) + BGS (50%)	8.00	8.24	6.98	7.74	8.97	7.78	7.65	8.13	8.98	7.98	6.57	7.84	8.65	8.00	7.06	7.90
N_5	FYM (50%) + BDF (50%)	7.75	8.06	6.92	7.58	8.89	7.71	7.59	8.06	8.62	7.85	6.21	7.56	8.42	7.87	6.91	7.73
N_6	Recommended package of practices (RPP)	7.29	7.22	6.73	7.08	7.87	7.04	6.89	7.27	7.47	6.54	5.37	6.46	7.54	6.93	6.33	6.93
N_7	Farmers' Practice	7.28	6.74	6.51	6.85	8.29	7.46	7.45	7.73	7.88	7.30	5.98	7.05	7.82	7.17	6.65	7.21
	Mean	7.71	7.80	6.96		8.69	7.60	7.48		8.56	7.62	6.15		8.32	7.67	6.83	
		S.Em±	CD @ 0.05			S.Em±	CD @ 0.05			S.Em±	CD @ 0.05			S.Em±	CD @ 0.05		
Cultivars (C)		0.25	0.97			0.16	0.64			0.18	0.71			0.11	0.44		
Nutrient management practices (NMP)		0.39	1.21			0.27	0.83			0.23	0.72			0.16	0.50		
Cultivars at same level of Nutrient management		0.75	2.03			0.58	1.59			0.51	1.22			0.36	0.96		
Cultivars at same or different level of Nutrient management		0.73	1.89			0.56	1.49			0.48	1.11			0.34	0.85		

FYM - Farm Yard Manure VC – Vermicompost BGS-Biogas slurry BDF - Biodigester filtrate
C_1 - SNK 635 C_2 – CO 86032 C_3- Konanakatte

Conclusion

The cultivars and nutrient management practices and their interactions did not influence significantly on non- reducing sugar %. Whereas, reducing sugar content was significantly influenced by cultivars and nutrient management practices. SNK 635 recorded significantly lower reducing sugars than Co 86032 and Konanakatte. Konanakatte reported significantly higher reducing sugars. Fat, protein, ash, moisture, colour and pH of liquid Jaggery were not significantly influenced by cultivars and organic treatments. Electrical conductivity of liquid Jaggery was significantly influenced by cultivars and nutrient management practices. SNK 635 recorded significantly lower EC values (1.11 dSm^{-1}) and Konanakatte recorded significantly higher values of 10.42 dSm^{-1}. SNK 635 quality liquid Jaggery with overall acceptability score point of 8.25. Organic nutrient management practices had significantly higher overall acceptability score points than RPP and farmer' practice treatment. In the interaction, SNK 635 with organic nutrient management treatments found better than other interactions.

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References

1. Anonymous. Official Methods of Analysis, 18th edition. Washington DC: Association of Official Analytical Chemists; c1980.
2. Anonymous. Agriculture Statistics at a Glance. New Delhi: Ministry of Agriculture and Farmers Welfare, Government of India; c2019.
3. Chikkappaiah Lava, Harish Nayaka MA, Manohar MP, Santhosh C. Properties of liquid Jaggery prepared using plant mucilage as clarificants. Int J Recent Sci Res. 2017;8(8):19590-19595.
4. Fogliata FA, Aso PJ. The effect of soil soluble salts on sucrose yield of sugarcane. Proc Int Sug Cane Technol. 1965;12:682-694.
5. Guddadamath SG, Sanjay B Patil, Khadi BM. Identification of sugarcane (*Saccharum* spp.) genotypes for organic Jaggery production. In: Proc. of the Natl. Sem. on Recent Advances and Challenges in Sugarcane Research, 23-24 January, Mysore, India; c2014. p. 28.
6. Howyzeh MS, Arzani A, Maibody M. Evaluation of Salt Tolerance of Sugarcane (*Saccharum officinarum* L.) Genotypes Based on the Ability to Regulate Ion Uptake and Transport at Early Stage of Growth. J Sci. Technol Agric. Nat Resour. 2008;11(42):565-575.
7. Jackson ML. Soil Chemical Analysis. New Delhi: Prentice Hall of India Pvt; c1973. p. 67-214.
8. Kale RA, Chinchorkar SV. Studies on quality of gur. Proc. 5th Conf. Sugar Res Dev Workers; c1964. p. 468-478.
9. Khan C, Verma AK, Anil K, Shahi NC. Effect of edible oil coating on quality parameters of Jaggery during storage. Sugar Tech. 2014;16(1):80-85.
10. Kuri S. Response of sugarcane genotypes to organic nutrient management practices with special reference to Jaggery production and quality. M. Sc. (Agri.) Thesis, University Agricultural Sciences, Dharwad, Karnataka, India; c2014.
11. Kuri S, Chandrashekar CP. Growth indices and yield of sugarcane genotypes under organic, inorganic and integrated nutrient management practices. Karnataka J Agric Sci. 2015;28(3):322-326.
12. Mandal D, Tudu SR, Mitra, De GC. Effect of common spacing materials on keeping quality of sugarcane Jaggery during monsoon season. Sugar Tech. 2006;8(2&3):137-142.
13. García M, Medina E. Effect of salt stress on salt accumulation in roots and leaves of two sugarcane genotypes differing in salinity tolerance. J Trop Agric. 2013;51(1-2):15-22.
14. Miller DD. Food Chemistry: A Laboratory Manual. New York: John Wiley and Sons; c1998. p. 153.
15. Nooli SS. Organic nutrient management on yield and quality of sugarcane and Jaggery. PhD Thesis, University Agricultural Sciences, Dharwad, Karnataka, India; c2019.
16. Saini SK, Rajesh A, Singh V, Sinha SK. Effect of fly ash, press mud cake and phosphorus solubilising bacteria (PSB) on yield, growth and quality of sugarcane. Indian Sugar. 2006;56:25-28.
17. Somogyi M. Note on sugar determination. J Biol Chem. 1952;200:145-154.
18. Usha R, Neena J, Shivaramu HS, Sheela K, Sunandasharan. Processing practices of Jaggery manufactures in Cauvery Command area of Karnataka. Coop Sugar. 2004;35(11):853-859.