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Influence of front line demonstration of new ragi variety ML-365

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Abstract
Ragi is a staple food grain of Kolar district, however its productivity is reducing as the year pass by. This may be due to many reasons, important causes among them are; lack of high yielding varieties, low soil fertility, scanty and untimely rainfall, prolonged dry spells etc. thus making ragi cultivation less profitable. Inorder to increase the crop yields and enhance the farmers income, development and introduction of new high yieldings varieties are utmost imperative. Thus with the moto of familiarization of the lately developed variety, a demonstartions were conducted to know the performance of new ragi variety ML-365. The demo was conducted for two consecutive kharif seasons of 2017 and 2018 with total of 55 demonstrations spaning five villages. The results of the demo revealed that demonstrated variety performed better than the local variety with respect to plant height, number of tillers/plant and number of fingers/plant. The grain yield increased from 19.94 to 25.59 q/ha and 21.88 to 32.70 q/ha with newly introduced ragi variety during 2017 and 2018 respectively. The benefit cost ratio increased from 1.06 to 1.24 and from 1.13 to 1.55 respectively for the two years with the introduction of new variety. Thus adoption of new technology was able to increase the farmers earnings additionally by Rs. 9991.25 and 26890.00 during 2017 and 2018 respectively. The results from the experiments confirm that the demonstrated new ragi variety ML-365 illustrated better performance and was able to increase the farmers income.

Keywords: Benefit cost ratio (B:C ratio), front line demonstration (FLD), krishi vigyan kendra (KVK), kolar, Ragi ML-365 and net returns

Introduction
India is a major millet producing country in the world, which account to about 43.85% of world total millets production (Thakur *et al*., 2017) [11]. Of the various types of millets produced in India, Ragi (*Eleusine coracana* (L.) Gaertn.) is a crucial crop of this millet group. Karnataka is one of the major ragi producing state in India, total occupying about 58.72% of area and 65% of country's total production (Sankaran, 2017) [8]. Ragi is also one of the major crop of the Kolar district and is a staple food of the region. This crop is very much suited for the district as the region falls under rainfed condition of the eastern dry zone of the Karnataka (Zone -5). Since the soils are shallow and their fertility status is poor to marginal. The area under ragi in the district is around 49824 ha with total production of 104582 tonnes and the productivity of the region is 20.99 q/ha. This crop is not only cultivated in the district of Kolar but also in Chikkaballapur, Bengaluru rural, Mandaya, Hassan and Tumakur districts of Karnataka.

Productivity of ragi is low, as the locally existing varieties are not much encouraging with respect to yield and hence the crop is considered as not economical of late (Thakur *et al*., 2017) [11]. Though this crop does not need much care and can be grown with minimal care, it is one of the nutrious crop among the cereals. Nutritive value of ragi includes; total carbohydrate 72.6%, protein 7.7%, fibre 3.6%, fat 1.5%, calcium 344 mg and iron 3.9 mg (Sarita, 2016; Muktar *et al*., 2018) [10, 6]. In recent years there is a huge market for the ragi, as it has lot of health benefits especially for those who are diabetic due to its low glycemic index (Sarita, 2016) [10]. Hence, in order to meet the high market, one of the available options is to increase the total production through higher productivity. This can be achieved through the introduction of high yielding varieties and this is extreme important for the success of millet industry

(Hiremath and Nagaraju 2009; Zala *et al*., 2013) [2, 13]. With this backdrop the field examination of new ragi variety was carried out as a front line demonstration (FLD) in two successive kharif seasons of 2017 and 2018 at five villages of Kolar district to bring awareness about the new ragi variety ML-365, to know the first hand information, its performance and its influence on the farmers income.

Materials and methods

The demonstration was carried out in two successive years during 2017 and 2018 cropping seasons and the full details of the demonstration is given in table 1. Each demonstation consists of one acre each of demo variety and check/farmer practice/local variety with total of 55 demos.

Table 1: Details of the demonstration conducted during two years

Year	Name of the village	Hobali	Taluk and district	No. of demos
2017	Kolaganjanahally	Sugatur	Kolar	05
	Busanahally	Sugatur	Kolar	15
	Byapanahally	Sugatur	Kolar	20
Number of demonstration for the year 2017				40
2018	Byapanahally	Sugatur	Kolar	05
	Mylandahally	Vokkalari	Kolar	10
Number of demonstration for the year 2018				15
Total number of demonstration				55

The operational details followed in the FLD is summarised below (table 2). Except the variety all other operations carriedout were similar in both check and the demo plots, which includes; sowing, thinning, weeding, harvesting and threshing etc. were coordinated according to the stage of the crop and whenever required. The check and demo plots were maintained side by side for the better comparison. All the operations stood similar but harvesting, threshing were done independently to get the separate yield data.

Soil properties and precipitation during the demonstration

The initial soil analysis was carried out by collecting the soil samples before sowing and before the application of FYM. The analysis was carried out according to the standard procedures and soil test based fertilizer application was followed. The results of the soil analysis are given in the table 3. Daily rainfall was recorded using rain gauze, the total annual rainfall and its distribution pattern during the two cropping seasons is given in figure 1 and 2 respectively along with the normal rainfall of the region.

Plant observations: The growth and performance of the new variety was observed by taking the growth-related parameters like the plant height (cm), number of tillers per hill/plant and fingers per plant. Observations were recorded in five replicates in each of the demo and control plots.

Yield parameters: The final yield of both grain (q/ha) and the stover/haulm (t/ha) was recorded separately after the harvest and also the farmers feedback at the end of the demonstrations.

Table 2: Operational details used for the demonstration

S. No.	Operation	Check (Farmers practice)	Demo (Improved practice)
1	Sowing season	Kharif	Kharif
2	Farming situation	Rain fed	Rain fed
3	Variety / Seed material used	GPU-28 (Local variety)	ML-365 (Improved Variety)
4	Organic manure	7.5 t/ha	7.5 t/ha
5	Seed rate	10 kg/ac	10 kg/ac
6	Bio fertilizers @ 250 g/Ac (Seed treatment)	Azospirillum	Azospirillum
7	Fertilizer (N-P-K): Half of N, applied as basal dose and half at tillering stage. Full dose of P and K was applied at the time of sowing.	50-40-25 kg/ha	50-40-25 kg/ha
8	Method of sowing	Broad casting	Broad casting

Table 3: Soil characteristics of the experimental plots

S. No.	Parameter	Soil test values	Method used
1	Soil texture	Red sandy loam	Buycos Hydrometer method
2	pH	6.88	pH meter (1:2.5 ratio)
3	EC (dS m^{-1})	0.35	EC meter (1:2.5 ratio)
4	Available Nitrogen (Kg/ha)	238.34	Alkaline potassium permanganate with Kjeldahl distillation
5	Available Phosphorus (Kg/ha)	40.50	Olsen's reagent with spectrophotometer
6	Available Potash (Kg/ha)	282.24	Neutral normal ammonium acetate with flame photometer

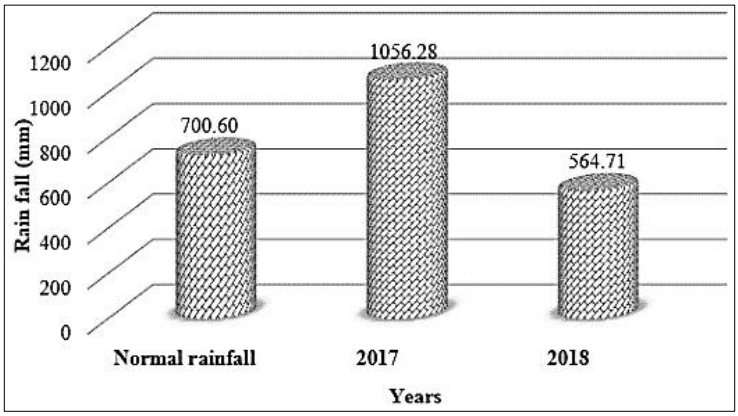

Fig 1: Total annual rainfall of Kolar district during the year 2017 and 2018 along with regional overal average rainfall.

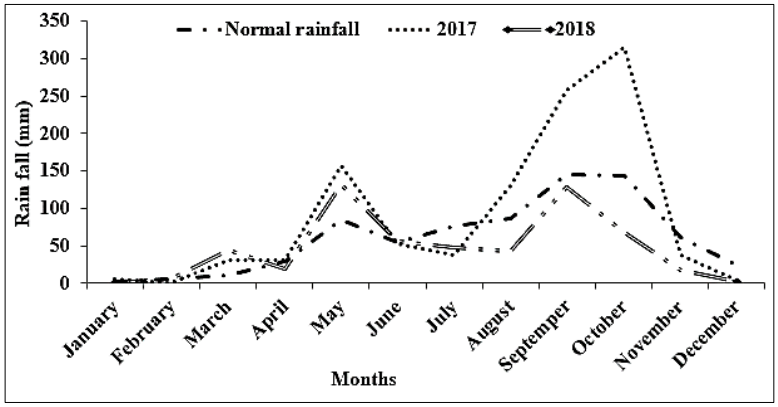

Fig 2: Comparative monthly rainfall distribution pattern of Kolar district during the cropping period of the demonstration

Net return and B: C ratio: All operations starting from the initial land preparation to harvest and threshing were recorded along with their costs on acre basis and they were used to calculate the gross cost, net returns, benefit - cost ratio (B: C ratio). From the collected information some other parameter were also calculated to find out the performance of the newly introduced variety and the gaps that exist with the demonstration (Yogesh *et al*., 2018; Thakur *et al*., 2017; Reddy *et al*., 2019) [12, 11, 7].

The additional parameters include

Extension gap Index /Demonstration Index = (Demo yield - Check yield) X 100 / Demo yield

Technology index = (Potential yield - Demonstration yield) x 100 / Potential yield

% increased over farmers practices = (Improved practices – Farmers practices) x 100 / Farmers' practices

Additional return = Demonstration return – farmer's practice return

Technology gap = Potential Yield – Demonstration Yield

Statistical analysis: Statistical analysis test was done to know whether the two varieties used in the demonstration are statistically different or not as previously described (Mahandrakumar *et al*., 2009) [4].

Results

Soil analysis results of the demo plots

The demonstration was carried out for two successive years i.e. 2017 and 2018 in total of five villages with 55 farmers and 55 demonstrations of one each of control and the new variety. The results of the soil analysis during both the years shows that the soils are neutral in pH, electrical conductivity is normal, available nitrogen is low, while it is medium in available phosphorus and potash. Thus, based on the soil test values we suggested 60 kg of nitrogen per hectare instead of 50 kg/ha (20% higher nutrient when the soil test values are low and 20% lower when the soil test values are higher). Nitrogen is applied in two splits half during sowing and remaining half during tillering, while the full quantity of phosphorus and potassium is applied at the sowing.

Kolar district rainfall and its distribution pattern during the experimental period

The district average normal rainfall is around 700.60 mm. The rainfall during 2017 is higher than the normal rainfall by 333.08 mm, while in 2018 the rainfall is 135.89 mm lower than the normal rainfall (figure 1). The distribution pattern of the same shows that there was more rain during land preparation, low during sowing and growing period and very high during the later stages of crop especially during pollination, grain filling and harvesting period during 2017 but it was opposite during 2018 (figure 2).

Plant growth and yield parameters

The results of the growth and performance of the demonstration for both improved ragi variety and control is given in table 4. The percentage growth of the plant in terms of height (cms) is significantly higher (increase of 10.8 and 22.19% respectively) compared to the farmers practice during 2017 and 2018 respectively, thus confirm this variety fetched more stover yield comparatively. Tillers number is significantly increased in demo variety from 4.78 to 7.14 (49.37% increase) and from 5.18 to 7.22 (increase of 39.38%) for 2017 and 2018 respectively. The results on the fingers per plant are significantly higher during both the years with increase from 6.30 to 8.26 (31.11% increase) and 5.92 to 8.66 (increase of 46.28%) respectively for the same years.

The total grain yield significantly increased in both the years and the increase was from 19.94 to 25.59 q/ha (28.33% increase) and 21.88 to 32.70 q/ha (increase of 49.45%) respectively for 2017 and 2018 cropping seasons. The net returns increased significantly over the local variety and the magnitude of increase was 6.61 and 4.73 times over the farmers practice for 2017 and 2018. The benefit cost ratio (B: C ratio) of the new variety increased to 1.24 and 1.55 compared to local variety of 1.06 and 1.13 for 2017 and 2018 respectively with an increase of 16.98 and 37.17% for the same period.

Economic returns

All the inputs and the operations like farm yard manure application, seeds, fertilizers, labour, tractor, harrowing, cutting, threshing were accounted to calculate the cost of cultivation. The gross cost, gross returns, net returns and the B:C ratio were calculated to now the economic feasibility of the demonstration. The result (table 4) shows that the newly introduced variety is highly different over the local variety. The net additional returns with the introduction of new technology are 9991.25 and 26890.00 for 2017 and 2018 respectively.

Table 4: Growth and performance of new variety GKVK-5 over the local variety

Parameters	2017		2018	
	Check	Demo	Check	Demo
Plant height (cm)	81.40±12.39	90.19±15.22*	73.78±5.08	90.15±12.03*
No. of tillers /plant	4.78±1.72	7.14±1.69*	5.18±0.48	7.22±0.73*
No. of fingers/plant	6.30±0.61	8.26±0.80*	5.92±0.56	8.66±0.66*
Grain yield (q/ha)	19.94±2.64	25.59±5.92*	21.88±1.64	32.70±1.75*
Stover yield (t/ha)	3.59±0.48	4.61±1.06*	3.92±0.26	4.48±0.37*
B:C ratio	1.06±0.29	1.24±0.38	1.13±0.14	1.55±0.22
Gross Income (Rs/ha)	76639.38	77197.50	71625.00	98815.00
Gross (Rs/ha)	74859.38	88968.75	64417.50	64717.50
Net Income (Rs/ha)	1780.00	11771.25	7207.50	34097.50
% increase over check	28.33		49.45	
Technology index	48.82		34.60	
Demonstration Index	22.08		33.09	
Additional return over the farmer practice (Rs/ha)	9991.25		26890.00	

***** - the demo average values are significantly different from the check at 5% levels

The technology index for the demonstration was 48.82 and 34.60; while the demonstration index was 22.08 and 33.09 for the year 2017 and 2018 respectively. Technology gap for the demonstration was 24.41 and 17.3 q/ha for the year 2017 and 2018 respectively, while the extension gap was 5.65 and 10.82 q/ha respectively for the same years.

Discussion

The performance of newly introduced ragi variety recorded has an improved plant height, tillers number and fingers per plant in both the years thus is the reason for higher stover yield and grain yield in the demo variety. These findings are similar to the conclusions made with onion, ragi and groundnut demonstration (Hiremath and Nagaraju 2009; Gowda *et al*., 2018; Reddy *et al*., 2019) [2, 1, 7]. Who reported that the newly introduced variety showed better over the control.

The total grain yield significantly increased in both the years and increased the net returns, thus the higher benefit cost ratio (B: C ratio) of the new variety. Similar findings were reported in other demonstrations (Thakur *et al*., 2017; Saravanakumar, 2018; Gowda *et al*., 2018 [11, 9, 1]; (Hiremath, S.M. and Nagaraju 2009) [2] (Hiremath, S.M. and Nagaraju 2009) [2] (Hiremath, S.M. and Nagaraju, 2009) [2] (Hiremath, S.M. and Nagaraju 2009) [2] (Hiremath, S.M. and Nagaraju, 2009) [2] (Hiremath, S.M. and Nagaraju 2009) [2]⁵ Mishra, 2019; Zala, 2013; Reddy *et al*., 2019) [5, 13, 7]. All these findings recorded higher B: C ratio due to the reason that the improved net returns is the result of better yield performance of demonstrated variety. The lower yield during the year 2017 might be due to the excess rainfall received during the flowering, grain filling and harvesting stages especially from the September to November (figure 2). Excessive rain during the flowering, pollination and grain filling stages of crop will reduce the grain yield. This is due poor grain filling caused by poor nutrient availability in the water logged condition (Johansson *et al*., 2015) [3].

Improved yield performance was due to the adoption of new variety through the front line demonstration. Thus the news technology enhance the productivity through higher yield, improved net returns and better B: C ratio over the farmers practice, thus the resultant favourable effect on the technological index, economical gap, extension index and technological index. The lower the values of these indexes indicate better adoption of technology and vice versa, indicating that there is lot of scope for improvement. Comparable findings were reported by other workers (Thakur *et al*., 2017; Mishra, 2019; Reddy *et al*., 2019) [11, 5, 7]. The lower the value of technology gap indicated the better performance of the technology, while the higher the value for extension gap indicate the better performance of the technology over the framers practice. Comparable observations were reported by other researchers (Thakur *et al*., 2017; Mishra, 2019; Reddy *et al*., 2019) [11, 5, 7].

In conclusion the front line demonstration of the newly introduced ragi variety ML-365 produced better performance over the local variety at farmer's field in all the 55 demonstrations. The introduced variety significantly increased the grain yield and fodder yield comparatively in the both the years. New variety significantly increased net returns, better B: C ratio and fetched additional income than the local variety. Thus front line demonstration exhibited that the new introduced variety is highly suitable for dry land agriculture and improved the farmer's income through enhanced productivity.

Conflict of interest: None, all the authors declared that there are no conflict of interest associated.

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