Performance of frontline demonstration on productivity and profitability of Utera cropping of linseed (*Linum Usitatissimum L.*) under rainfed condition in tribal district Balaghat of Madhya Pradesh

ABSTRACT

The study was carried out by College of Agriculture Waraseoni (Balaghat), Madhya Pradesh in the agroclimatic zone of the Chhattisgarh plains to know the yield gaps between improved package and practices under front line demonstration (FLD) and farmer's practice (FP) of Utera cropping of Linseed under rainfed condition. Front Line Demonstration on Linseed were conducted on farmer's fields during Rabi season of year 2016-17 to demonstrate the impact of enriched agro-techniques on production and economic benefits under rainfed conditions. FLD's were conducted in 11.20 ha with active involvement of 28 farmers and scientific staff of Institution. According to analysis of data the highest grain yield was obtained in demonstrated plots with an average of 7.25 q/ha as compared to local check with an average of 4.94 q/ha. An average mean of extension gap, technology gap and technology index were calculated as 2.31q/ha, 2.75q/ha, 27.53% respectively. Adoption of improved package of practices in Linseed cultivation recorded average higher IBCR ratio (2.99) as compared to Farmers Practice during the period of study. Thus, the productivity of Linseed could be increased with the adoption of recommended improved package of practices. The study resulted in satisfying the farming community for higher productivity and returns.

Key words: Front line demonstration, Linseed, Technology gap, Extension gap, Yield.

Introduction:

Linseed (*Linum usitatissimum L.*) is one of the oldest cultivated plants in the world [1]. It is a dual-purpose crop, and grown for seeds and fibre [2]. The oil content of the seed varies from 33-47%. Linseed oil is an excellent drying oil used in manufacturing paints and varnishes, oilcloth, waterproof fabrics and linoleum and as edible oil in some areas. Linseed-cake is a very good manure and animal feed. Linseed is used in making paper and plastics. A well-distributed rainfall of 450 to 500 mm is sufficient to grow good crop of linseed, hence fit well in the rainfed cropping system. Linseed (*Linum usitatissimum L.*) belongs to the family Linaceae and the genus Linum. Linseed is basically an industrial oilseed crop and its each and every part is important with commercial and medicinal use. It is tolerance to biotic and abiotic stresses that is characteristic of this crop. Because of this property the cultivation of linseed is prevailing in wide range of tropical, sub-tropical and temperate regions. Linseed is an important crop grown both for its seed as well as fibre which is used for manufacture of linen. The flax seed contains high level of dietary fibres and high amount of micronutrients. It also contains omega-3-fatty acids (*linoleic acid*) that make it edible and it is also useful for heart patients. On a very small scale, the seed is directly used for edible purposes and about 20% of the total oil is used and remaining 80% of the oil goes to industries for the manufacture of paints, varnishes and printing ink, oil cloths, soap and water proof fabrics. The oil cake is most valuable feeding cake for animals, it contains 36% protein and 85% of it is digestible fibre. The oil cake is also used as manure; it contains 5% nitrogen (N), 1.4% phosphorus (P2O5) and 1.8% potassium (K2O) [3].

In India Linseed grown on 174.87 Thousand Hectare area and produced 111.36 Thousand Tonnes with productivity of 637 kg/ha. However, in Madhya Pradesh it cultivated only on 47.00 Thousand Hectare and contributes 36.80 Thousand Tonnes with a productivity of 783 kg/ha.Linseed is an important Rabi oilseed crop of rainfed season of Balaghat district of Madhya Pradesh grown on area of 6015 Hectare and produced 2346 Tonnes with productivity of 390 kg/ha [4].

The productivity of oilseed in the district is low as compared to National average mainly due to poor crop management practices ultimately and inadequate availability of quality seed of improved Linseed varieties and other inputs. To increase the productivity of linseed in Balaghat district the adequate and balance supply of plant nutrients along with high yielding varieties is of critical importance. Demonstration of promising technologies on farmer’s fields is an effective method of extension. Knowledge and skills gained through the demonstration plots can be easily transferred from farmer to farmer. The productivity of linseed per unit area could be increased by adopting recommended scientific and sustainable management practices using a suitable high yielding cultivar. Taking into account the above considerations, Frontline Demonstrations (FLDs) were carried out in a systematic manner on farmer’s field to show the worth of new varieties and application of balance nutrients and convincing farmers to adopt improved production management for enhancing productivity of Linseed.

Material and Methods:

The Balaghat district of Madhya Pradesh is located in the extreme South-West of the Madhya Pradesh state and occupies the south eastern portion of the Satpura Range and the upper valley of the Wainganga River. The district extends from 21°19' to 22°24' North latitude and 79°31' to 81°3' East longitude with quadrangle shape.The Balaghat district is characterized by varying soil types ranging from a mixed red and yellow to shallow and moderately deep soil strata with low water holding capacity.Soils of the Balaghat district are poor in available nitrogen and phosphorous. However, medium to high Potassiumis available with pH range 6.4 to 7.2. The climate of the zone is typically semi-humid and sub-tropical with hot dry summers and cold winters. The mean minimum temperature of the zone varies from 16^o to 30^o C (June to Nov.) at Balaghat with average annual rainfall of 1250 mm.The field crops of district in Rabi are rice, wheat, chickpea, teora, urad, moong, mustard, linseed[5].

The constraints inproduction were identified through participatoryapproach such asfarmer's meetings, trainingprogrammes and field diagnostic visits duringcrop growth period. Low yield of Linseed wasconceived due to lack of suitable variety of Linseed,imbalance use of fertilizers, drought, infestation of weeds and improper cropgeometry. Based on the farmer's problems, The College of Agriculture, Waraseoni(Balaghat) conducted FLD's on Linseed during season of *Rabi* 2016-17by Utera sowing method onvarieties JLS-27 (High Omega-3 content, moderately resistant to powdery mildew and bud fly), Indira-32 (Erect plant, Blue flower, brown seeded, medium size) and Kartika (moderately resistant to rust, wilt & Alternaria blight and resistant to Powdery mildew)[6] under Rainfed ecosystem at Waraseoni Block of Balaghat District of Madhya Pradesh (Table 1).

In Utera condition, sowing of crop was done before the harvesting of preceding crop, in our case, crops were grown in rice field, on other hand rainfed crop grown in rainfed situation, means totally depend on rainfall and irrigated condition, hence they need irrigation only in their critical stage. In India the area of linseed occupied under rainfed is 63% and Utera 25%. Utera is the most traditional practices followed in rice fields where sowing by broadcasting linseed in standing rice fields just before 15 to 20 days of rice harvest when last irrigation is given. During such time the field were wet. Linseed is mostly preferred for Utera because of mucilaginous seed coat which does not stick on rice plant [7].

The area under each demonstration was 0.4 ha.The farmers selected for demonstrations were from different social background having rice area ranging from 2.5 to 5 acres.

Table 1: Front line demonstration andcarrying out site.

Year	Variety	Check	No. of FLD	Area (ha)	Village	Block
2016-17	JLS-27 Indira-32 Kartika	Local	28	11.2(0.4ha/FLD)	Kope	Waraseoni

To manage the identified problems, JLS-27, Indira-32 and Kartika varieties seeds wereprovided to the farmers as critical inputs andscientific recommended technologies (Table 2) werefollowed as intervention during the course offront line demonstration programme.

Table 2: Technological intervention and farmer's practices under FLD.

Particulars	Technological intervention	Farmers practices
Farming Situation	Rainfed	Rainfed
Variety	JLS-27, Indira-32 and Kartika	Local
Seed rate (kg/ha)	25	30-35
Seed treatment	Carbendazim 12% + Mancozeb 63% (2g/Kg)	NO
Time of sowing	15th to 25th October	15th to 25th October
Sowing Method	Utera	Utera
Fertilizer (NPK) Kg/Ha	40:25:00	Nil or 30:00:00
Weed management	Pendimethalin 30 EC (2.5 lt/ha) One hand weeding at 30-35 days after sowing	One hand weeding at 30-35 days after sowing
Insects	Pod Fly: Profenofos 50% EC (1 lt/ha)	Nil
Diseases	Powdery mildew: Hexaconazole(750ml/ha)	Nil
Harvesting	5th to 15th March	1st to 10th March

The demonstrations on farmer's fields wereregularly monitored from sowing toharvesting. In case of local check (control plots), existing farmers' practices were followed by thefarmers. Well before conducting thedemonstrations, a training programme wasorganized for the selected farmers of therespective villages for the season to impart thetechnological knowledge of Linseed productiontechniques. All other steps like site selection, layout of demonstrations, farmers' participationetc. were followed. The grain yield of demonstrations as wellas farmers' practice (local check) were recordedand analysed according to different parameters. The details ofthese parameters are as:

Extension gap = Demonstration yield–Farmer's yield

Technology gap = Potential yield - Demonstration yield

$$\text{Technology index } (\%) = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

Additional Cost = Demonstration cost of cultivation - Farmer's cost of cultivation

Additional Return = Demonstration return - Farmer's return

Effective Gain = Additional return - Additional cost

$$\text{Increment B: C ratio} = \frac{\text{Additional return}}{\text{Additional cost}}$$

Result and Discussion:

Table 3: Gap in grain yield production of Linseed varieties under FLDs.

Season-Year variety	Potential Yield (q/ha)	Demonstration Yield (q/ha)	Farmer`s practice Yield (q/ha)	Increase over Farmer`s practices (%)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
Rabi -2016-17 JLS-27	10.00	7.49	5.14	45.72	2.35	2.51	25.10
Rabi-2016-17 Indira-32	10.00	7.16	4.90	46.12	2.26	2.84	28.40
Rabi-2016-17 Kartika	10.00	7.09	4.78	48.33	2.31	2.91	29.10
Average	10.00	7.25	4.94	46.72	2.31	2.75	27.53

Grain yield: The increase in grain yield underdemonstration was 45.72-48.33%than farmers' local practices. On the average basis, 46.42% yield advantage wasrecorded under demonstrations carried outwith improved cultivation technology as compared to farmer's traditional way oflinseed cultivation.

Gap analysis: An extension gap of 2.26-2.35 q/ha was foundbetween demonstrated technology andfarmer's practices during the yearand on average basis the extension gap was 2.31 q/ha (Table 3). The extension gap was lowest 2.26 q/ha for Indira-32 and was highest 2.35 q/ha for JLS-27 during *Rabi* 2016-17. Such gapmight be attributed to adoption of improvedtechnology in demonstrations which resultedin higher grain yield than the traditionalfarmer's practices. Wide technology gap wasobserved during the year and this waslowest 2.51 q/hafor JLS-27 and was highest 2.91 q/hafor Kartikaduring*Rabi* 2016-17. On average basis the technology gap of total 28 demonstrations was found as 2.75 q/ha. The difference in technology gapcould be due to morefeasibility of recommended technologies. Similarly, thetechnology index for all the demonstrationswere in accordancewith technology gap. Higher technologyindex reflected the inadequate proventechnology for transferring to farmers andinsufficient extension services for transfer oftechnology.Technology index shows the feasibility of thevariety at the farmer's field. The lower thevalue of technology index more is thefeasibility. Table 3 revealed that theaverage technology index value was 27.53.

Table 4: Economic impact of Linseed varieties under FLD.

Season-Year variety	**Cost of cultivation (Rs/ha)**		**Additional cost in Demo. (Rs./ha)**	**Sale price (MSP) of (Rs./q)**	**Net Return (Rs/ha)**		**Additional return in Demo. (Rs./ha)**	**Effective gain (Rs./ha)**	**IBCR**
	Demo.	FP			Demo.	FP			
Rabi -2016-17 JLS-27	12750	10150	2600	4500	20955	12980	7975	5375	3.07
Rabi-2016-17 Indira-32	12750	10150	2600	4500	19470	11900	7570	4970	2.91
Rabi-2016-17 Kartika	12750	10150	2600	4500	19155	11360	7795	5195	3.00
Average	12750	10150	2600	4500	19860	12080	7780	5180	2.99

Economic analysis: Different variables like seed, fertilizers and pesticides were considered ascash inputs for the demonstrations as well asfarmer's practice and on an average anadditional investment of Rs. 2600 per ha wasmade under demonstrations. Economicreturns as a function of grain yield and MSPsale price during the year.The maximum net return (Rs. 20955 per ha) by JLS-27 was obtained due to the higher grain yield. The higheradditional returns and effective gain obtainedunder demonstrations could be due toimproved technology, non-monetary factors, timely operations of crop cultivation andscientific monitoring. The lowest and highest incremental benefit: cost ratio (IBCR) were 2.91 & 3.07 forIndira-32 and JLS-27respectively (Table 4) depends on producedgrain yield. Overall average IBCR was found as 2.99.

Conclusion:

The results indicated that the Front Line Demonstration has given a positive and significant impact over the farming community of Balaghat district as they were motivated by the new agricultural technologies applied in the demonstrations. The demonstrated technologies were superior in every aspect compared to existing practices. Through FLD programme productivity of Linseed has been increased up to 46.72% hence increases income.

The existing technology and extension gap should be minimized through imparting scientific knowledge to the farmers by extension personnel. However, the yield level under FLD was superior over local Linseed variety and performance & potentiality of this variety could be further improved by adopting recommended management practices. The participating farmers play an important role in disseminating technologies to the neighbouring farmers. The FLD shows great impact on the use of improved varieties.

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