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To Quantify Production Potential of Non-Spiny Safflower to other *rabi* Crops and Intercropping Systems

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ABSTRACT: *The field investigation experiment was conducted during* rabi *season of 2011 at farm of All India Coordinated Research Project (AICRP) on safflower, VNMKV Parbhani (Maharashtra) it was observed that various* rabi *crops and intercropping system tested in* rabi *season, in comparison to spiny safflower (Annigeri-1) and other* rabi *crops and intercropping systems, non-spiny safflower cultivars* viz., *PBNS-40, SSF-658 and NARI-6 gave maximum safflower equivalent yield (SEY). Non-spiny safflower cultivars (PBNS-40, SSF-658 and NARI-6), spiny safflower cultivar (Annigeri-1), sole sorghum, and sorghum + safflower (2:1) intercropping system recorded maximum net monetary returns and Sole sorghum and sole chickpea recorded highest benefit: cost ratio..*

Key words*: Non-spiny, Safflower, SEY, Economics.*

INTRODUCTION

The vegetable oil of oilseed crop is an integral part of the diet of human beings. The involvement of oil and oil products as the major constituents of all balanced dietary patterns emphasis their importance. Besides the dietary needs, the vegetable edible oils have numerous mechanical, industrial, medicinal and therapeutic uses too. Hence, the achievement of self sufficiency in production of edible oils is essentially credit worthiness to the nation. The review of past experiences indicated that there has been serious imbalance in the availability through the domestic production and demand of oils in the country. So our annual per capita consumption of oils and fats remained only 14.8 kg as against 41 kg in developed countries and 26 kg world average (Hegde 2012). Safflower (*Carthamus tinctorius* L.) is an important *rabi* oilseed crop of Maharashtra. Apart from its superior adaptability to scanty moisture conditions, it produces oil rich in polyunsaturated fatty acids (Linoleic acid, 78%) which play an important role in reducing the blood cholesterol level. For centuries, it has been under cultivation in India for its coloured florets and much valued oil. It posses deep root system which binds soil particle and thus, prevent erosion.

The average safflower productivity in the Maharashtra 509 kg ha^{-1} (Anonymous, 2012). Some of the major reason given for decline in area and production of safflower in India and Maharashtra is like higher remuneration than safflower obtained for competing crops like sorghum and gram over the years, low oil content of 30% or less, due to spiny nature harvesting is difficult manually. Petal yield is another good alternative source of income to farmer from safflower. Petals have great export potential. Petals can be used in preparation of refreshing herbal tea. Florets are used to colour and flavor soups, rice, sauces, bread and pickle (Sarojini *et al*., 1995). Since a majority of safflower varieties grown in India were spiny, collecting flowers from them was tedious, time-consuming and labour-intensive. However, with the national releases of non-spiny varieties, it is now possible in India to collect flowers economically by hand without the help of a machine.

There is a continuous decline in area under safflower during last decade due to other competing crops and constraints. In order to exploit full potential of non-spiny safflower with its edible oil and petal values, it was felt necessary to undertake present study in *rabi* season to compare productivity and profitability of non-spiny safflower with other *rabi* crops and intercropping systems including spiny safflower which are generally practiced in the Marathwada region of Maharashtra..

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MATERIAL AND METHODS

The experiment was laid out in field plot number A-4 at AICRP on safflower, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *rabi* season of 2011. the soil of experimental plot was clayey in texture, moderate in organic carbon, poor in nitrogen, medium in available phosphorus and high in potash and slightly alkaline in reaction. Geographically, Parbhani is situated at 409 m mean sea level altitude 19^0 16' North latitude and 76^0 47' east longitude and has a subtropical climate. The experiment consists of 10 treatments *viz;* T_1 PBNS-40(Non spiny), T_2 SSF-658(Non spiny.), T_3 NARI-6(Non spiny.), T_4 Annigeri-1 (spiny), T_5 (Chickpea sole), T_6 (Linseed sole), T_7 (Sorghum sole), T_8 Chickpea + safflower (3:1), T_9 Linseed + safflower (3:1) and T_{10} Sorghum + safflower (2:1) in randomized block design along with three replications. Gross and net plot sizes were 5.4 x 6 m^2 and 3.6 x 4.8 m^2, respectively. The sowing was done by dibbling method on 24th October, 2011.

RESULT AND DISCUSSION

It was observed from Table 1 and 2 that, Seed yield, petal yield and safflower equivalent yield (SEY) of safflower and other *rabi* crops were significantly influenced by different cropping system.

In case of safflower highest seed yield (1860 kg ha^{-1}) was recorded by sole spiny safflower(Annigeri-1) followed by non-spiny safflower cultivar PBNS 40 (Non spiny). It is observed that the safflower is the better crop in sole cropping in this region under minimal irrigationManjithkumar *et al*., (2009), reported that yield of safflower and other *rabi* crops were always highest in sole cropping system compared to intercropping system. Singh *et al*., (2009), Uke *et al*., (2009), Anonymous (2012 a), Anonymous (2012 c) and Somananagouda *et al*., (2012) reported that maximum yield of safflower was recorded by spiny safflower cultivar and which was on par with non-spiny safflower.

In case of chickpea highest seed yield (1627 kg ha^{-1}) of chickpea was recorded by sole chickpea than intercropping with safflower. Similar finding were observed by Jadhao *et al*., (1990), Paslawar and Morey (1990), Singh and Yadav (1993).

In case of linseed highest seed yield (571 kg ha^{-1}) of linseed was recorded by sole linseed than intercropping with safflower. Similar finding were observed by Kulmi and Chundawat (1997).

In case of sorghum highest seed yield (2110 kg ha^{-1}) of sorghum was recorded by sole sorghum than intercropping with safflower.

In case of petal yield of safflower highest petal yield of safflower was recorded in sole stands as compared to intercropping due to less plant population. Non-spiny safflower cultivars *viz*., PBNS-40, SSF-658 and NARI-6 recorded higher petals yield of safflower than spiny cultivar Annigeri-1. Shinde *et al.,* (2009), Anonymous (2012b), Anonymous (2012b) reported that the highest petal yield of safflower always highest recorded by non-spiny safflower cultivars over spiny cultivars of safflower due to convenience in harvesting.

In case of safflower equivalent yield (SEY) Non-spiny safflower cultivar PBNS-40 (Non spiny) recorded highest (3146 kg ha^{-1}) safflower equivalent yield followed by other non-spiny safflower cultivar SSF-658 (Non spiny) and NARI-6 (Non spiny) (Fig. 1). The safflower equivalent yield indicates the superiority of growing of non-spiny safflower than spiny safflower and other *rabi* crops/intercropping systems. This was due to better yield and prevailing market prices (Table 26). Similar finding were observed by Anonymous (2012b), Anonymous (2012c) and Anonymous (2012d).

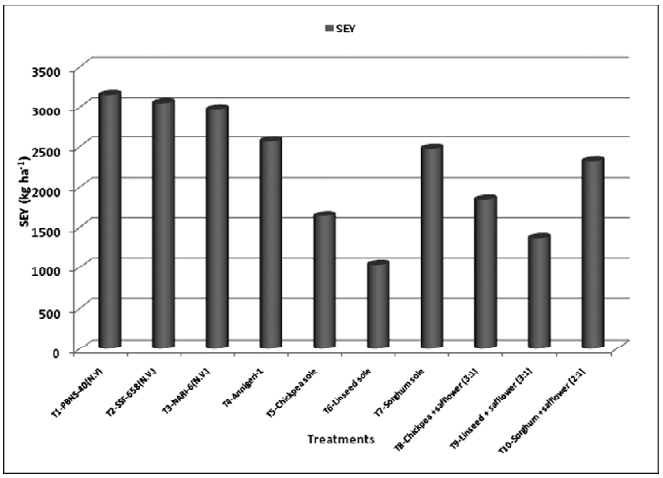

Figure 1: Mean safflower equivalent yield (kg ha^{-1}) as influenced by various treatments

In case of economics highest gross monetary (69,522 Rs. ha^{-1}) and net monetary returns (4,822 Rs. ha^{-1}) were recorded by non-spiny safflower cultivar PBNS-40 (N.V.) followed by other non spiny safflower cultivars NARI-6 and SSF-658. This was due to increased gross returns and net returns from safflower petals. While, B:C ratio of was found to be highest with sole sorghum (3.90) followed by sole chickpea. This is due to increased cost of cultivation of safflower than other *rabi* crops/intercropping systems because cost of picking petals was high in spiny (Rs. 300/kg) and non-spiny (Rs 240/kg) safflower cultivars.

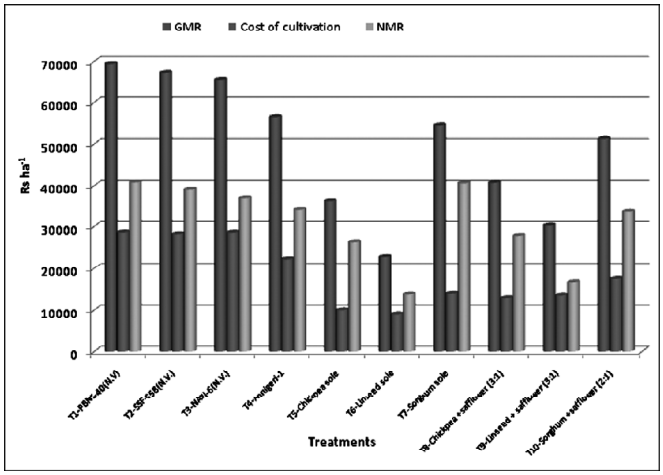

Figure 2: Economics of safflower and other *rabi* crops as influenced by various treatments

Although sole sorghum and sole chickpea recorded higher B:C ratio but maximum net returns similar to that of sorghum were recorded by non-spiny safflower cultivars *viz*., PBNS-40, SSF-658 and NARI-6; spiny safflower cultivar Annigeri-1 and sorghum + safflower (2:1) intercropping system (Table 28). These results were supported by findings of Anonymous (2012b), Anonymous (2012c) and Anonymous (2012d) (Fig. 2).

Table 1
Seed yield and straw yield, of safflower and other *rabi* crops as influenced by various treatments

	Seed yield (kg ha^{-1})					
Treatments	*Safflower*	*Chickpea*	*Linseed*	*Sorghum*	*Petal yield (kg ha^{-1})*	*SEY (kg ha^{-1})*
T_1-PBNS-40 (Non spiny)	1671	–	–	–	65.00	3146
T_2-SSF-658 (Non spiny)	1611	–	–	–	63.27	3048
T_3-NARI-6 (Non spiny)	1503	–	–	–	64.80	2971
T_4-Annigeri-1 (Spiny)	1860	–	–	–	31.05	2563
T_5-Chickpea sole	–	1627	–	–	–	1644
T_6-Linseed sole	–	–	571	–	–	1034
T_7-Sorghum sole	–	–	–	2110	–	2474
T_8-Chickpea + safflower (3:1)	114	1496	–	–	9.64	1845
T_9-Linseed + safflower (3:1)	170	–	473	–	15.24	1371
T_{10}-Sorghum + safflower (2:1)	133	–	–	1685	11.57	2322
SE+	134	–	–	–	3.190	130
CD at 5%	413	–	–	–	9.830	386
General mean	**1009**	**1561**	**522**	**1898**	**37.22**	**2241**

Table 2
Economics of safflower and other *rabi* crops as influenced by various treatments

Treatments	*GMR (Rs ha^{-1})*	*Cost of cultivation (Rs ha^{-1})*	*NMR (Rs ha^{-1})*	*B : C ratio*
T_1-PBNS-40(N.V)	69422	28600	40822	2.44
T_2-SSF-658(N.V.)	67259	28184	39075	2.39
T_3-NARI-6(N.V.)	65563	28551	37012	2.31
T_4-Annigeri-1	56566	22315	34251	2.53
T_5-Chickpea sole	36296	10000	26296	3.63
T_6-Linseed sole	22840	9000	13840	2.54
T_7-Sorghum sole	54608	14000	40608	3.90
T_8-Chickpea + safflower (3:1)	40710	12892	27817	3.15
T_9-Linseed + safflower (3:1)	30253	13561	16692	2.24
T_{10}-Sorghum + safflower (2:1)	51244	17471	33773	2.93
SE+	2873	-	3083	0.22
CD at 5%	8535	-	9161	0.68
General mean	**49476**	**18457**	**31018**	**2.80**

Sales prices: Safflower- Rs. 2207 qtl^{-1}, Chickpea- Rs. 2232 qtl^{-1}, Linseed- Rs. 4000 qtl^{1}, Sorghum- Rs. 2002 qtl^{-1}, Safflower petals- Rs. 500 kg^{-1}, Sorghum fodder- Rs. 3 kg^{-1}.

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