Farmers' income from oilseeds production in India: Trends and prospects

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ABSTRACT

Oilseeds are of pivotal significance in the agricultural economy of India supporting income of millions of farmers practicing mainly rainfed cultivation. Profitability of oilseeds is an important concern for enhancing domestic production in order to reduce import dependence for edible oils. The present study attempts to analyze the trends in real income from oilseed crops in selected states and discuss some of the underlying factors using secondary data from the cost of cultivation surveys for selected states during the period 2000-01 to 2014-15. Farm income from oilseeds has increased in the states with higher proportionate rise in price realized and or yield of the crop as compared to the change in cost of inputs. Profitability of oilseeds has declined in the states with higher proportionate increase in cost of inputs as compared to the yield or decline in the real price received. The factors which affected change in income from oilseeds included change in yield realized, farmers' price and change in cost of inputs. There exists a large yield gap for oilseeds across states on account of poor adoption of production technologies and lower application of productive and protective inputs. The yield gap can be narrowed down through ensuring quality input supply at affordable prices, increase adoption of production technology and price support with effective procurement. Efforts are to be enhanced to improve water use efficiency through protective irrigation, effectiveness of extension services to enhance productivity and profitability, and in turn farmers' income.

Keywords: Cost and profitability, Farmers' income, Oilseeds, Prospects, Trends

The oilseed sector has been an area of concern for policy makers and research managers, as the country is import dependent to fulfil its growing edible oil requirement. This sector occupies an important position in the agricultural economy of the country as oilseeds accounts for about 13 per cent of gross cropped area and contributes to about 10 per cent of total value of output from agricultural crops and 6.0 per cent of value of output from agriculture and allied sector (Sharma, 2016c; Teja *et al.,* 2017). Rising income levels and changing food habits of the growing population in India is leading to faster increase in the demand of edible oils as compared to the production growth, as the demand for edible oils is highly income and price-elastic (Srinivasan, 2005). The demand for edible oils skyrocketed in the recent years and the import of edible oils has reached to nearly 70% of the total requirement in the country. The mismatch between demand and supply is continually widening as the production growth is not matching up with the growth (6%) in demand (Jha *et al.,* 2012; IIOR, 2015). A portion of this ever growing demand can be met by enhanced domestic production provided the increase in the level of productivity is achieved by bridging the yield gap.

Productivity of major edible oilseed crops in India is one third of global average. Majority of oilseeds are cultivated in rainfed ecosystem on marginalised land (Jha *et al.,* 2012) predominantly with low and erratic rainfall and under input starved conditions coupled with poor crop management (IIOR, 2015) resulting in low yield realisation and thus, income from oilseeds. The area under oilseeds in general is not increasing due to their low and uncertain profitability at the prevailing yield levels and marketing situations. Large scale inter regional and inter district productivity differences for oilseeds do exist (Sharma, 2014) due to various technological, weather related and other factors. There exists a realisable yield gap of about 20-50 per cent across oilseed crops (Jha *et al.,* 2012; Sharma, 2016c), bridging this will not only enhance domestic availability of edible oils through higher production of oilseeds in the country, but the profitability, provided the remunerative prices are given to the farmers which would enhance the income of oilseed growers.

Profitability of oilseeds is an important concern for reducing import dependence through increasing domestic production of oilseeds. There are many challenges for reducing import dependency to save foreign exchange or attaining self-sufficiency and to make oilseeds cultivation profitable to farmers. Enhancing the yield and quality through research and technology dissemination under favourable policy environment could help achieve the goals. Earlier studies have estimated the farmers' income from different sectors such as agriculture and allied sectors and from non-farm sector and changes in the level of income over time (Bhatia, 2006; Chand *et al.,* 2015; Kannan, 2015; Chand, 2017). It is also important to understand the changes/trends in income from or profitability of different crops or crop groups and their underlying factors in order to prepare plan and strategies to enhance profitability and income from different crops. Under this backdrop, the

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present study makes an attempt to analyze the trends in real income from oilseed crops in selected states and discuss some of the underlying factors. The study also reviews the constraints in oilseeds production and marketing in order to deepen the understanding on this sector and help policy makers and research managers to make strategies to enhance yield and profitability, and in turn, farmers' income.

MATERIALS AND METHODS

The study was based on secondary data compiled from the Cost of Cultivation of Principal Crops in India for the period 2000-01 to 2014-15. The data from cost of cultivation surveys are used to analyse the trends in income from oilseeds at state level. The cost of cultivation survey is conducted annually by the Ministry of Agriculture and Farmers' Welfare to collect farm-level data on inputs, output and prices. To compute per hectare cost in and income from oilseeds, both inputs and output data were deflated by relevant price deflators at 2004-05 prices. Material inputs and other items were deflated by the respective wholesale price indices, and agricultural labour wages were deflated by the consumer price index for agricultural labourers. Various crop outputs were also deflated by using the respective wholesale price indices. The states were selected on the basis of continuous data availability for the respective oilseed crops from 2000-01 to 2014-15.

RESULTS AND DISCUSSION

Changes in cost in and income from oilseeds in major states: The cost of cultivation surveys provide details of input costs and the value of output of oilseed crops grown across major states. The states selected for the present study, based on data availability for the selected period without gap, included Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu for Groundnut; Assam, Gujarat, Haryana, Rajasthan, Uttar Pradesh and West Bengal for Rapeseed and Mustard; Maharashtra for Safflower; Odisha for Niger seed; Gujarat, Odisha, Rajasthan and Tamil Nadu for Sesamum; Madhya Pradesh, Maharashtra and Rajasthan for Soybean; and Andhra Pradesh and Karnataka for Sunflower.

On the basis of cost of cultivation survey data, Commission for Agricultural Costs and Prices (CACP) uses different cost concepts to work out the alternative incomes from crop production. The paid out cost, Cost A_2, is widely used for analytical purposes to track the changes in the welfare of farmers, which includes all actual expenses in cash and kind incurred by cultivators, and rent paid for leased-in land. Another cost concept, Cost A_2 plus family labour represent real farming costs and is relevant in assessing the expenses incurred in the cultivation of a crop (Kannan, 2015; Sen and Bhatia, 2004).

In order to understand the changes in income from cultivation of oilseeds, net income, farm business income and net income over cost A_2 plus family labour were estimated as the difference between gross value of output (GVO) and total cost of cultivation, paid out cost and paid out cost plus family labour, respectively. The average real cost in and income from groundnut cultivation for the periods 2000-01 to 2004-05 and 2010-11 to 2014-15 are presented on Table 1. The states for which the real cost in and income from groundnut cultivation were estimated included Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu. These states together accounted for 82 per cent of total area and 80 per cent production of groundnut in the country. It is evident from the table that the costs in and returns from groundnut cultivation were lower in Karnataka as compared to other states, as the use of material inputs and yield of the crop was lower in the state.

The average real net income per hectare from groundnut cultivation was negative in Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu, although per hectare loss has shown declining trend in all these states except in Karnataka. The net income from groundnut cultivation has declined over the period in Gujarat, while it improved and turned positive in Maharashtra. Since the increase in GVO was higher than the cost in Andhra Pradesh, Maharashtra and Tamil Nadu states, the improvement in farm income was higher in these states (Table 1). The average farm business income and net income over Cost A_2 plus family labour from groundnut cultivation was positive and has marginally improved over the period in all the states except in Gujarat. The improvement in average farm business income and net income over Cost A_2 plus family labour was mainly due to increase in productivity of the crop on account of higher use of productive inputs mainly nutrients from fertilizers and price realisation by the farmers over the period. Narayanmoorthy (2013) and Narayanmoorthy *et al.* (2014) also reported declining profitability of groundnut crop in Tamil Nadu and Gujarat states.

As an alternative measure, the changes in farm business income from groundnut cultivation are also presented in the form of the ratio of the GVO to Cost A_2 and to total cost (Fig. 1A to 1E). As expected, the income to total cost ratio was lower than the income to cost A_2 ratio. The point to worry is that the ratio of income to total cost was lower than one in all the states except in Gujarat, although it improved marginally in the recent period. Income to paid out cost ratio also marginally improved in all the states with some exceptions. This was mainly due to more than proportionate rise in the income on account of higher yield and higher prices realised by the farmers, as compared to changes in cost of material inputs and other costs.

For safflower, the cost of cultivation data was compiled for Maharashtra state that contributed more than 50 per cent area and production in the country. More than proportionate

increase in the income from sunflower cultivation as compared to input costs led to higher improvements in the farm business income as well as other income measures in Maharashtra (Table 2). Although there was a steep increase in the cost of material inputs and other input costs, more than proportionate rise in yield over the period resulted in higher increase in income from safflower cultivation in Maharashtra.

The trend in the ratio of gross value of output from safflower cultivation per hectare in Maharashtra to paid out cost and to total cost is depicted in Fig. 1.F. These alternative measures of farm income increased from 2003-04 till 2011-12 and then started declining mainly due to decline in price realisation and yield in the recent period due to drought. Ratio of gross value of output to total cost was >1 during this period.

In case of Rapeseed and Mustard, the states selected for analysis were Assam, Gujarat, Haryana, Rajasthan, Uttar Pradesh, and West Bengal, which together accounted for about 79 per cent of area and 82 per cent of production in the country. The proportionate rise in gross value of output from rapeseed and mustard was higher than the increase in costs in Gujarat, Haryana and Uttar Pradesh states leading to higher change in net income per hectare. The net income per hectare from rapeseed and mustard was negative in Assam due to low productivity and higher input costs, while it declined in Rajasthan (Table 3) on account of decrease in productivity and price realisation by farmers.

Although price realised by farmers have declined in all the states, more than proportionate rise in the yield realised coupled with low increase in input cost helped increase per hectare net income and farm business income in the states of Gujarat, Haryana, Uttar Pradesh and West Bengal. Costs in and returns from R&M cultivation were lowest in Assam and highest in Haryana due to larger differences in yield and input applications.

The trend in ratio of gross value of output to total cost of cultivation of rapeseed and mustard was >1 in all the states except in Assam where it was <1 and declining (Fig. 2.A to 2.F). The GVO to total cost ratio is improving in Gujarat, and West Bengal, while started declining recently in the states of Haryana, Rajasthan and Madhya Pradesh due to lower price realization in the recent years. The ratio of GVO to paid out cost fluctuated over the years, increased during the period from 2007-08 and 2010-11 to 2011-12. As expected, the ratio of GVO to paid out cost was above the ratio of GVO to total cost.

For sesamum, the states selected were Gujarat, Odisha, Rajasthan and Tamil Nadu based on the continuity in the data availability, although Madhya Pradesh, Uttar Pradesh and West Bengal also were among major producers of sesamum in the country. Per hectare cost in and returns from sesamum cultivation were higher in Gujarat and Tamil Nadu states as compared to Odisha and Rajasthan on account of higher use of productive and protective inputs such as fertilizers and manure, plant protection chemicals and irrigation. The average gross value of output per hectare from sesamum cultivation has decreased in all the selected states (Table 4) over the period due to decline in price realized except in Gujarat where yield increase was higher than the price decline.

With the more than proportionate increase in inputs cost as well as total cost in cultivation of sesamum as compared to gross value of output on account of decrease in prices realized, average net income as well as farm business income has declined in all the states (Table 4). The average net income per hectare from cultivation of sesamum turned negative in Gujarat and Rajasthan also during the period 2010-11 to 2014-15. Farm business income as well as net income over cost A_2 plus family labour also decreased in all the selected states due to decline in price realized by farmers and higher increase in inputs cost.

The ratio of gross value of output to total cost was <1 in Odisha and Tamil Nadu states for whole period under analysis (Fig. 3.A to 3.D) and started going <1 in Gujarat and Rajasthan due to decrease in yield in the recent period due to drought. The trend in ratio of gross value of output to paid-out cost is also declining due to higher proportionate rise in input cost as compared to gross revenue from crop. The gap between the two ratios is narrowing in all the states on account of faster growth in material input costs.

The states selected for soybean were Madhya Pradesh, Maharashtra and Rajasthan, which together accounted for about 94 per cent of area and production of the crop in the country. The paid out cost as well as total cost per hectare in cultivation of soybean was higher in Maharashtra as compared to Madhya Pradesh and Rajasthan (Table 5). Farmers in Maharashtra use higher amount of fertilizers (almost double of Madhya Pradesh and five times of Rajasthan) and manures, and apply irrigation to the crop in case of water stress and, thus, reap higher productivity and higher income. Sharma (2016a and 2016b) also reported the increasing net returns from soybean cultivation.

The rise in per hectare gross value of output from soybean cultivation was proportionately higher than the cost in Madhya Pradesh and Rajasthan, while increase in cost was higher than GVO in Maharashtra on account of larger change in inputs costs and decline in productivity growth. The net income as well as farm business income has increased in Madhya Pradesh and Rajasthan, while decreased in Maharashtra (Table 5).

The alternative measures of farmers income, the ratio of GVO to total cost and to paid out cost of soybean cultivation is declining in Maharashtra and gone below one on account of decline in productivity while the ratios have started declining recently in Madhya Pradesh and Rajasthan due to

decrease in yield on account of weather woes and fall in prices received. The gap between the two ratios is also narrowing indicating that the increase in cost of material inputs was much higher than the imputed value of rent of owned land and interest on fixed capital, as is evident from the steep fall in the ratio of GVO to Cost A_2 (Fig. 4A to 4C). Use of seed per hectare was higher than recommended in Madhya Pradesh and Rajasthan, while use of plant nutrients was much lower resulting in lower yields.

For niger seed, Odisha state was selected for analysis on the basis of cost of cultivation data availability on continued basis for selected period, although the area under the crop is highest in Madhya Pradesh. The productivity of niger seed is very low and the cost of cultivation, which comprises mainly human and animal labour inputs, is higher, and hence the net income per hectare was negative. With the higher proportionate rise in cost as compared to yield and GVO, the change in negative net income has increased (Table 6). The farm business income has increased from niger seed cultivation in Odisha over the period. The crop is grown without application of productive (fertilisers and manures, irrigation) and protective inputs (plant protection inputs) in Odisha. The ratio of gross value of output to total cost was <1 due to poor productivity realized and increase in cost. The ratio of gross value of output to paid out cost was fluctuating and declined till 2007-08 started improving again dropped in the recent year (Fig. 4D).

In case of sunflower, Andhra Pradesh and Karnataka, which together contributed to about 74 per cent of area and 65 per cent of the production of crop in the country, were selected. The per hectare cost in and returns from sunflower cultivation were higher in Andhra Pradesh as compared to Karnataka as the use of productive and protective inputs was higher in the state. Due to comparatively higher inputs and other cost, the net returns from the crop were negative in Andhra Pradesh, which further increased marginally during the recent period on the productivity decline. Whereas, in Karnataka average per hectare net income from sunflower cultivation turned positive in the recent period and the change in farm business income and net income over cost A_2 plus family labour was higher (Table 7). The productivity of the crop has improved in the state leading to higher proportionate change in income.

The ratio of gross value of output to total cost was <1 in both the states with year-to-year fluctuations and started declining in Andhra Pradesh after 2011-12 due to steep decline in average yield, while improving in Karnataka on account of higher yield and lower change in input costs. Ratio of gross value of output to paid-out cost fluctuated widely in both the states (Figure 5A and 5B).

Table 1 Average real crop cost, output value and income from groundnut

Items	Total Cost (₹/ha)	Cost A_2 (₹/ha)	Cost A_2+FL	GVO (₹/ha)	Net Income (₹/ha)	FBI (₹/ha)	NI/Cost A_2+FL
Andhra Pradesh							
2000-01 to 2004-05	17731.36	10179.22	11926.64	15732.96	-1998.4	5553.74	3806.32
2010-11 to 2014-15	33182.69	19053.95	22355.64	32789.67	-393.02	13735.72	10434.03
Change (%)	87.1	87.2	87.4	108.4	-80.3	147.3	174.1
Gujarat							
2000-01 to 2004-05	18423.63	11069.88	13606.79	24059.25	5635.62	12989.37	10452.46
2010-11 to 2014-15	26562.59	17222.19	20682.17	29911.57	3348.99	12689.38	9229.40
Change (%)	44.2	55.6	52.0	24.3	-40.6	-2.3	-11.7
Karnataka							
2000-01 to 2004-05	12676.17	8685.81	9609.56	11428.90	-1247.27	2743.09	1819.34
2010-11 to 2014-15	19442.54	12750.65	14977.67	17308.50	-2134.03	4557.85	2330.83
Change (%)	53.4	46.8	55.9	51.4	71.1	66.2	28.1
Maharashtra							
2000-01 to 2004-05	25244.71	16526.09	20117.64	21223.15	-4021.56	4697.07	1105.51
2010-11 to 2014-15	28376.54	17231.75	21951.19	29293.98	917.43	12062.22	7342.78
Change (%)	12.4	4.3	9.1	38.0	-122.8	156.8	564.2
Tamil Nadu							
2000-01 to 2004-05	28609.57	17139.46	20612.31	24124.18	-4485.39	6984.72	3511.87
2010-11 to 2014-15	30044.16	18365.8	24049.58	28022.31	-2021.85	9656.51	3972.73
Change (%)	5.0	7.2	16.7	16.2	-54.9	38.3	13.1

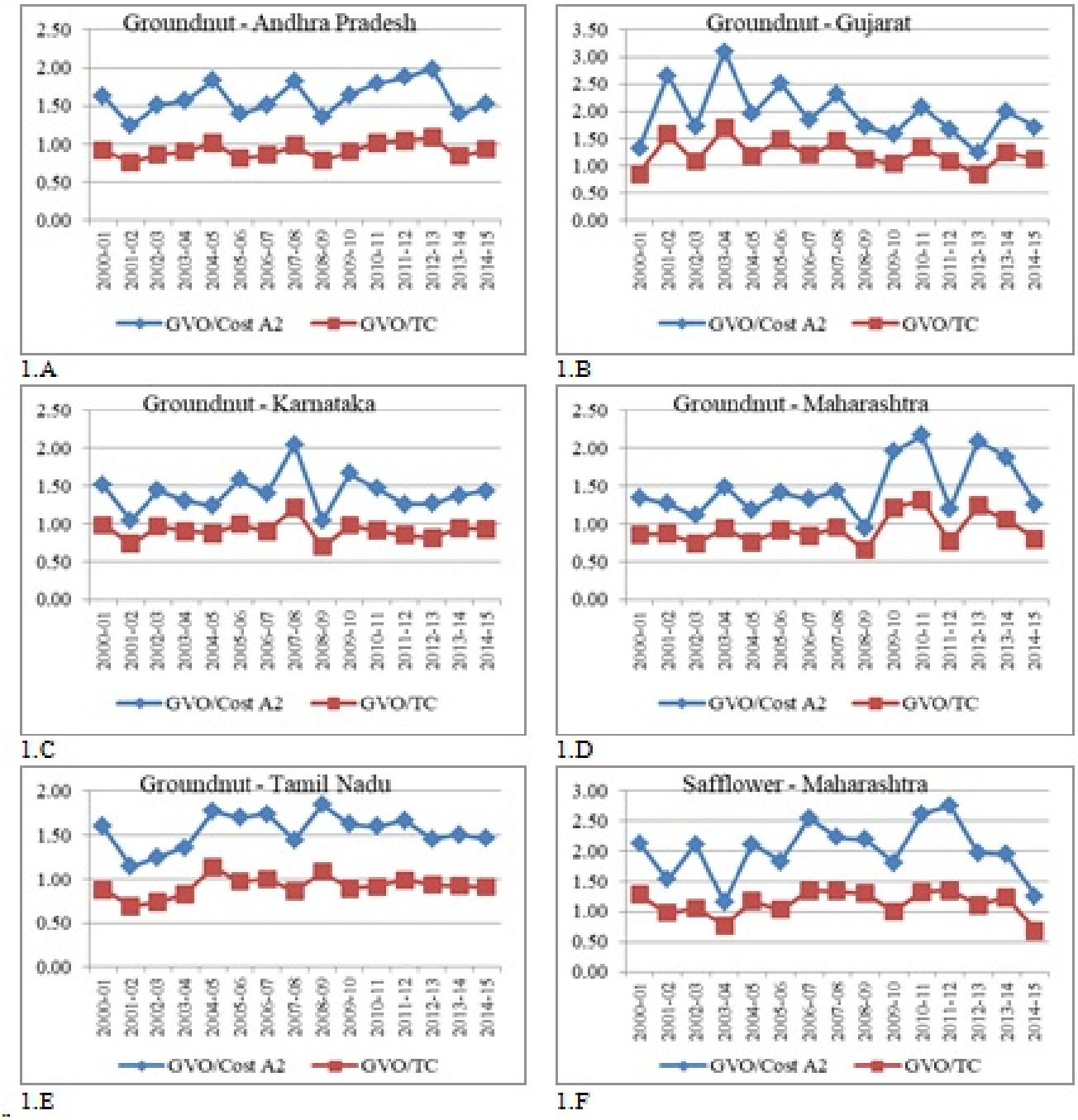

Fig. 1A-1F. Ratio of GVO to Cost A_2 and to total cost in groundnut and safflower

Income from oilseeds - some explanation of factors influencing: The level of income obtained from any crop is determined by several factors. The major factors include the level of productivity of crop, changes in input cost and price realized by farmers. Other supporting factors are water and soil management practices, market infrastructure and government policies and procurement support. Some of the factors have been discussed earlier in the paper; input use, price and procurement related factors are elaborated to improve the understanding.

Input use and productivity: Scholars have argued that oilseeds are mainly grown under rainfed ecosystem on marginalized lands (Jha *et al.,* 2012) with minimum use of productive and protective inputs (Sharma, 2014; IIOR, 2015) and hence, the average productivity of oilseeds in India is

low. Although, seed rate used by farmers was found to be in excess (10-30 per cent) of the rate recommended for some of the oilseeds, particularly for kharif oilseeds (Annexure-1). The higher seed rate results in higher plant population, which ultimately lowers the yield realization. Use of recommended seed rate by farmers not only can save 10-20 per cent in the seed cost to the farmers but also increase the productivity of the crop due to optimum plant stand without plant to plant competition for nutrients, space and other inputs. Sharma (2016b) also reported that soybean farmers use higher than recommended seed rate and lower dose of fertilizers and manures, impacting the yield realisation by the farmers.

Since oilseeds are mainly grown rainfed on marginal lands with minimal use of productive and protective inputs, the use of plant nutrients to the oilseed crops in almost all the states was lower than the recommended dose (Annexure-1). Applying recommended dose of plant nutrients to the crop can enhance the yield and thus increase gross value of output from oilseeds. Providing protective irrigation is critical to the yield realization from oilseeds particularly under moisture stress conditions. Since, most of the oilseeds are grown rainfed, by applying irrigation at critical stages under moisture stress condition there is scope for improving productivity and profitability of oilseeds, as the marginal rate of returns (varies between 1.45 to 3.77) from water use was considerably high across oilseed crops (Mruthyunjaya *et al.,* 2005).

Table 2 Average real crop cost, output value and income from safflower

Items	TC (₹/ha)	Cost A_2 (₹/ha)	Cost A_2+FL	GVO (₹/ha)	Net Income (₹/ha)	FBI (₹/ha)	NI/Cost A_2+FL
Maharashtra							
2000-01 to 2004-05	6520.08	3905.90	4654.71	6794.06	273.98	2888.17	2139.36
2010-11 to 2014-15	13393.25	7360.78	9698.71	15304.01	1910.76	7943.23	5605.30
Change (%)	105.4	88.5	108.4	125.3	597.4	175.0	162.0

Table 3 Average real crop cost, output value and income from Rapeseed and Mustard

Items	TC (₹/ha)	Cost A_2 (₹/ha)	Cost A_2+FL	GVO (₹/ha)	Net Income (₹/ha)	FBI (₹/ha)	NI/Cost A_2+FL
Assam							
2000-01 to 2004-05	10452.13	4307.54	7953.93	9157.07	-1295.06	4849.53	1203.14
2010-11 to 2014-15	14824.72	6770.09	11416.80	11662.98	-3161.74	4892.89	246.18
Change (%)	41.8	57.2	43.5	27.4	144.1	0.9	-79.5
Gujarat							
2000-01 to 2004-05	17923.95	10623.47	12514.10	25428.9	7504.95	14805.42	12914.8
2010-11 to 2014-15	18257.49	9069.07	11560.85	30725.87	12468.38	21656.81	19165.02
Change (%)	1.9	-14.6	-7.6	20.8	66.1	46.3	48.4
Haryana							
2000-01 to 2004-05	20097.8	7842.364	11063.02	26135.96	6038.16	18293.60	15072.94
2010-11 to 2014-15	23048.09	8193.297	11064.83	33950.13	10902.04	25756.83	22885.30
Change (%)	14.7	4.5	0.0	29.9	80.6	40.8	51.8
Rajasthan							
2000-01 to 2004-05	15611.81	6587.30	9145.31	26665.59	11053.78	20078.29	17520.29
2010-11 to 2014-15	15873.73	5863.19	9498.79	25809.85	9936.11	19946.66	16311.06
Change (%)	1.7	-11.0	3.9	-3.2	-10.1	-0.7	-6.9
Uttar Pradesh							
2000-01 to 2004-05	16835.93	7173.20	9356.30	20193.33	3357.40	13020.13	10837.03
2010-11 to 2014-15	19134.19	7158.27	10449.69	23884.79	4750.60	16726.52	13435.10
Change (%)	13.7	-0.2	11.7	18.3	41.5	28.5	24.0
West Bengal							
2000-01 to 2004-05	17301.93	8593.89	11671.8	19558.39	2256.46	10964.50	7886.59
2010-11 to 2014-15	20368.64	10537.46	14095.21	23064.20	2695.56	12526.74	8968.99
Change (%)	17.7	22.6	20.8	17.9	19.5	14.2	13.7

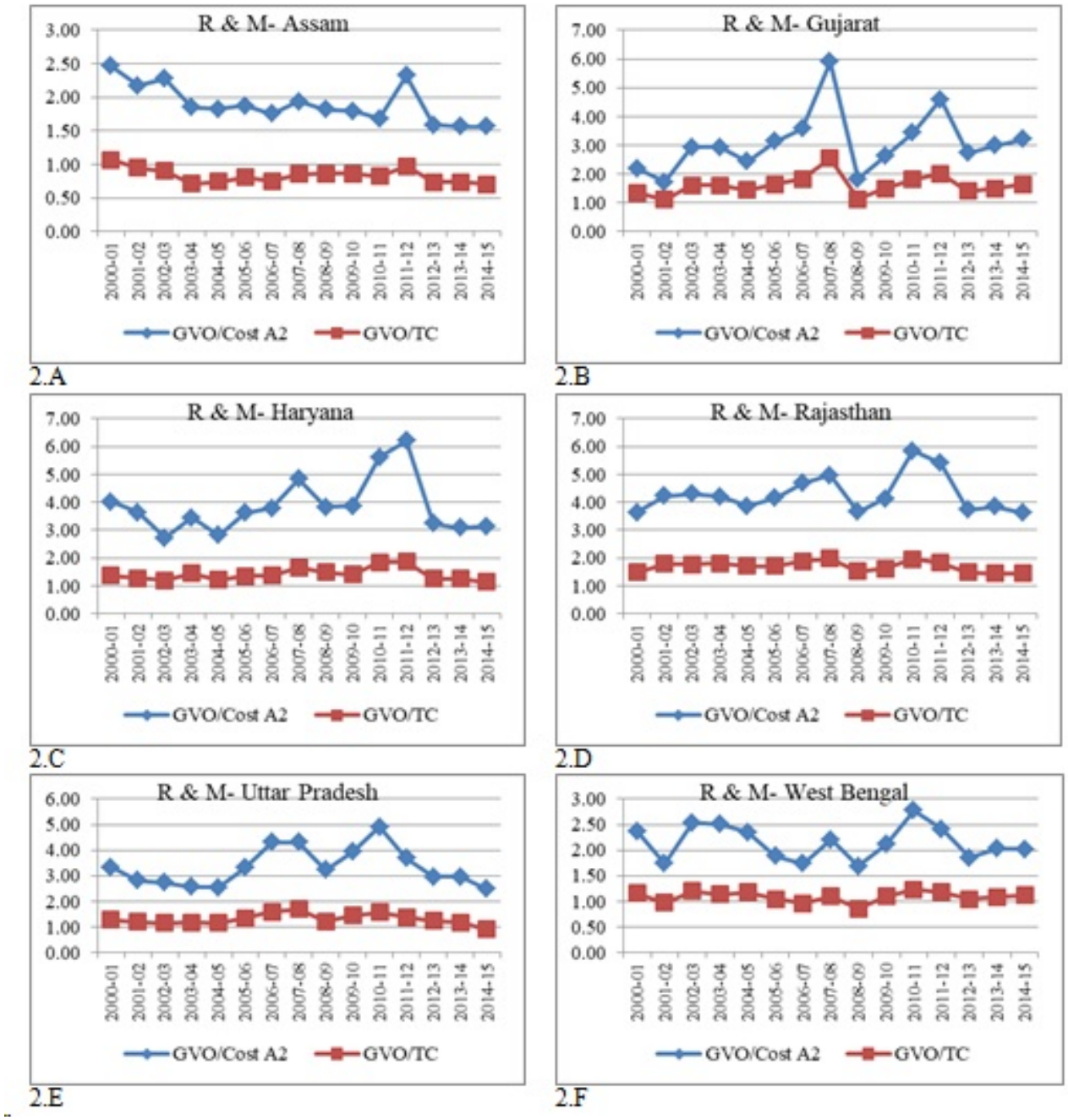

Fig. 2A-2F. Ratio of GVO to Cost A_2 and to total cost in Rapeseed and Mustard

Price policy and procurement: Minimum support prices (MSP) announced by the government for about 25 commodities including oilseeds every year which acts as a floor price and influences the price formation in the markets for agricultural commodities. Scholars reported that the MSP announced by the government for agricultural commodities has increased substantially over the period (Parikh *et al.* 2003). The fact is that the MSP has increased over time in nominal terms, but in real value (deflated by the respective commodity-specific wholesale price index) it has actually declined for some of the oilseeds (Fig. 6). Kannan (2015) also reported that the real MSP of agricultural commodities have declined over time. Although, real minimum support prices started improving after 2008-09 in case of rapeseed and mustard, safflower and sunflower.

Table 4 Average real crop cost, output value and income from sesamum

Items	TC (₹/ha)	Cost A_2 (₹/ha)	Cost A_2+FL	GVO (₹/ha)	Net Income (₹/ha)	FBI (₹/ha)	NI/Cost A_2+FL
Gujarat							
2000-01 to 2004-05	9111.11	5566.83	6872.57	11344.99	2233.881	5778.16	4472.42
2010-11 to 2014-15	12755.79	7685.24	10409.40	12234.26	-521.53	4549.02	1824.86
Change (%)	40.0	38.1	51.5	7.8	-123.3	-21.3	-59.2
Odisha							
2000-01 to 2004-05	6803.35	3966.94	4543.81	6585.02	-218.33	2618.09	2041.22
2010-11 to 2014-15	6976.12	3029.51	5357.12	5145.89	-1830.23	2116.38	-211.23
Change (%)	2.5	-23.6	17.9	-21.9	738.3	-19.2	-110.3
Rajasthan							
2000-01 to 2004-05	6665.22	1958.91	4438.79	7759.31	1094.10	5800.41	3320.52
2010-11 to 2014-15	6555.60	2235.25	4742.17	6316.02	-239.58	4080.77	1573.85
Change (%)	-1.6	14.1	6.8	-18.6	-121.9	-29.6	-52.6
Tamil Nadu							
2000-01 to 2004-05	14665.64	6723.14	8458.19	13219.70	-1445.94	6496.56	4761.52
2010-11 to 2013-14	12926.88	6881.13	9896.45	11462.69	-1464.19	4581.56	1566.25
Change (%)	-11.9	2.3	17.0	-13.3	1.3	-29.5	-67.1

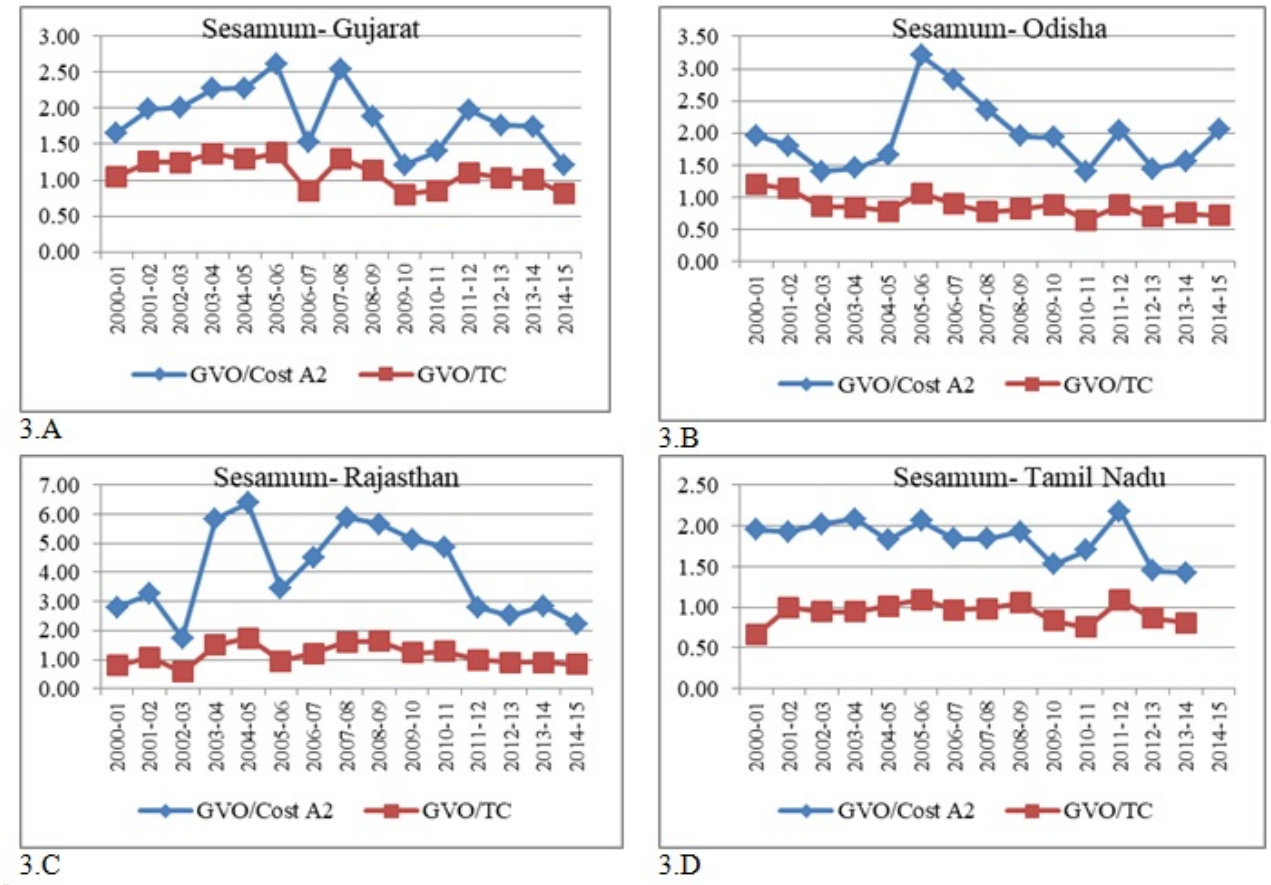

Fig. 3A-3D. Ratio of GVO to Cost A_2 and to total cost in sesamum

Table 5 Average real crop cost, output value and income from soybean

Items	TC (₹/ha)	Cost A_2 (₹/ha)	Cost A_2+FL	GVO (₹/ha)	Net Income (₹/ha)	FBI (₹/ha)	NI/Cost A_2+FL
Madhya Pradesh							
2000-01 to 2004-05	13578.88	7220.12	8657.93	15501.76	1922.89	8281.64	6843.84
2010-11 to 2014-15	15209.64	8184.91	9908.32	18914.12	3704.49	10729.21	9005.80
Change (%)	12.0	13.4	14.4	22.0	92.7	29.6	31.6
Maharashtra							
2000-01 to 2004-05	17672.82	12112.51	13032.35	20216.09	2543.26	8103.58	7183.74
2010-11 to 2014-15	20163.08	13684.36	15353.85	20971.81	808.73	7287.45	5617.96
Change (%)	14.1	13.0	17.8	3.7	-68.2	-10.1	-21.8
Rajasthan							
2000-01 to 2004-05	11522.72	6338.38	8141.34	13935.18	2412.46	7596.80	5793.84
2010-11 to 2014-15	12583.33	6456.85	8687.94	16044.51	3461.18	9587.67	7356.57
Change (%)	9.2	1.9	6.7	15.1	43.5	26.2	27.0

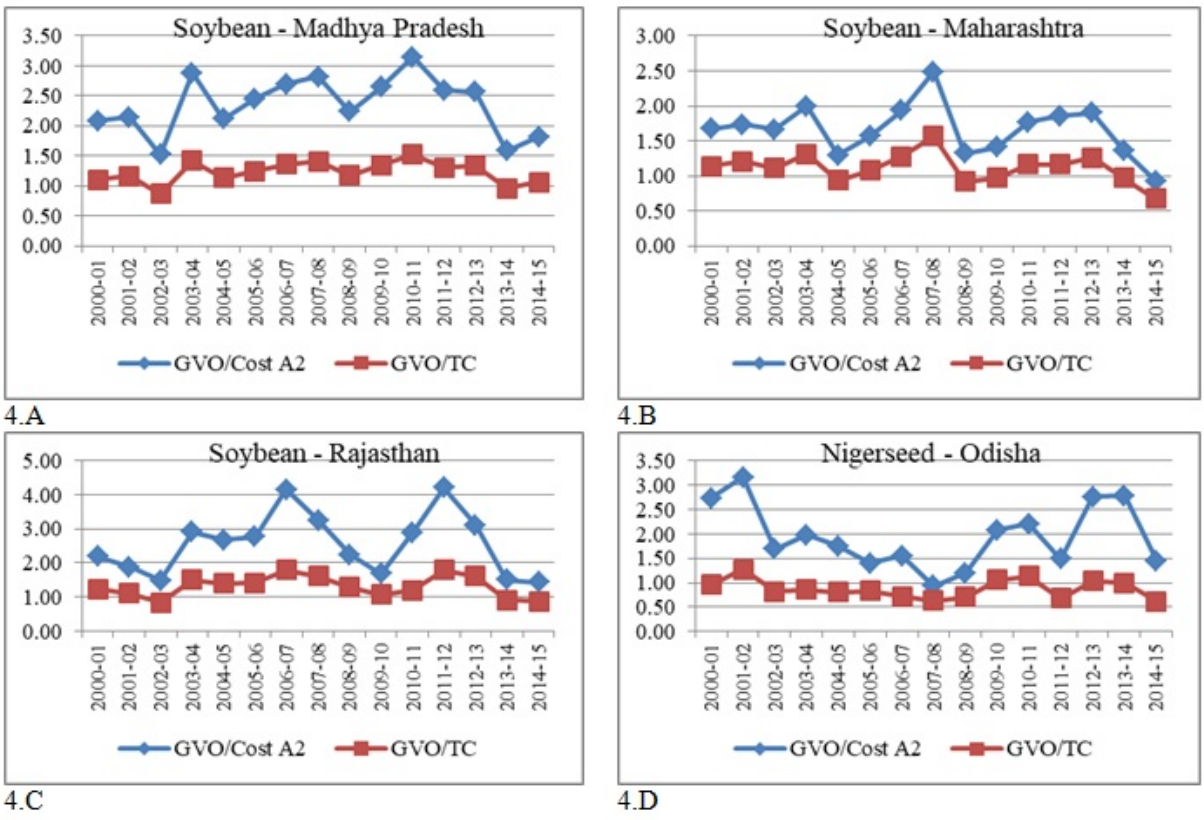

Fig. 4A-4D. Ratio of GVO to Cost A_2 and to total cost in soybean and nigerseed

Table 6 Average real crop cost, output value and income from Nigerseed

Items	TC (₹/ha)	Cost A_2 (₹/ha)	Cost A_2+FL	GVO (₹/ha)	Net Income (₹/ha)	FBI (₹/ha)	NI/Cost A_2+FL
Odisha							
2000-01 to 2004-05	6211.70	2609.68	4167.34	5910.07	-301.63	3300.39	1742.73
2010-11 to 2014-15	8348.20	3511.11	6006.20	7408.05	-940.146	3896.94	1401.86
Change (%)	34.4	34.5	44.1	25.3	211.7	18.1	-19.6

Table 7 Average real crop cost, output value and income from sunflower

Items	TC (₹/ha)	Cost A_2 (₹/ha)	Cost A_2+FL	GVO (₹/ha)	Net Income (₹/ha)	FBI (₹/ha)	NI/Cost A_2+FL
Andhra Pradesh							
2000-01 to 2004-05	14821.29	8476.46	10260.67	12182.68	-2638.61	3706.22	1922.01
2010-11 to 2014-15	18535.56	10689.73	13128.33	15868.65	-2666.90	5178.93	2740.32
Change (%)	25.1	26.1	27.9	30.3	1.1	39.7	42.6
Karnataka							
2000-01 to 2004-05	9530.46	6218.86	6979.82	8601.22	-929.24	2382.36	1621.40
2010-11 to 2014-15	10775.95	6809.75	7771.25	11249.37	473.42	4439.62	3478.12
Change (%)	13.1	9.5	11.3	30.8	-150.9	86.4	114.5

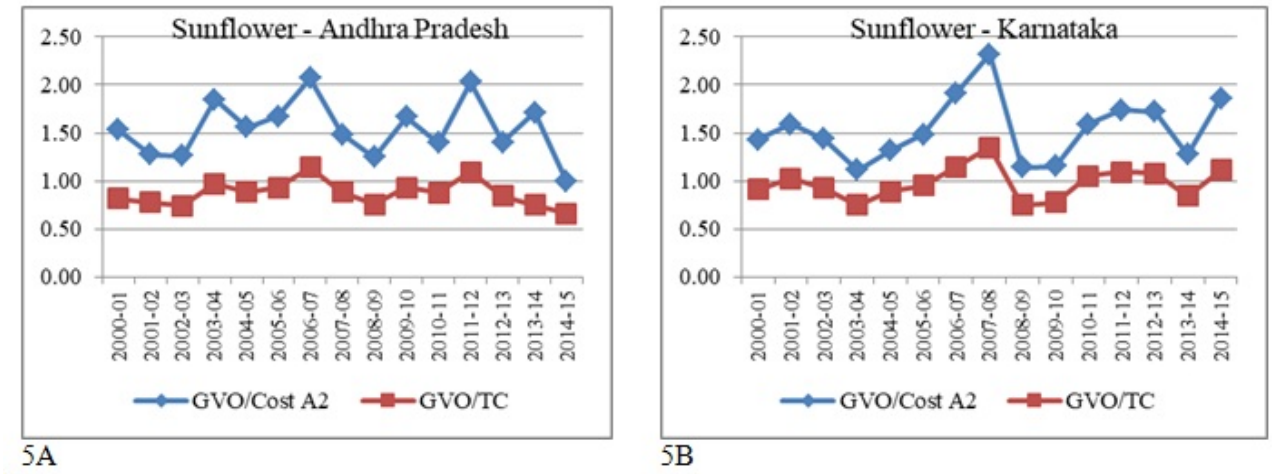

Fig. 5A-5B. Ratio of GVO to Cost A_2 and to total cost in sunflower

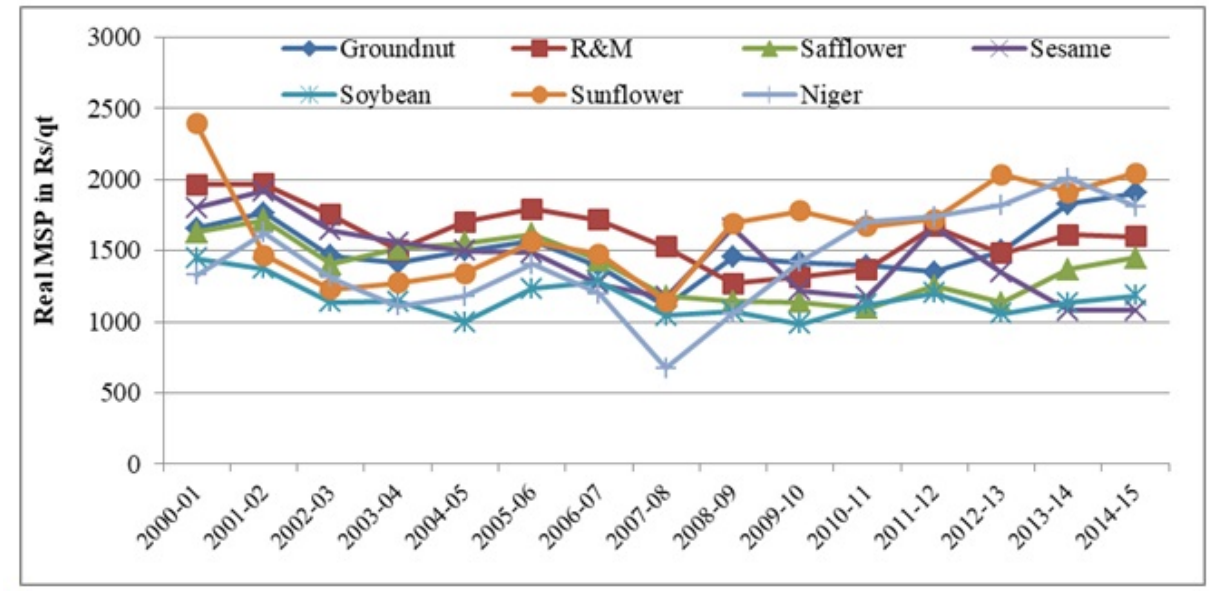

Fig. 6. The trend in real minimum support price of oilseeds (₹/qt)

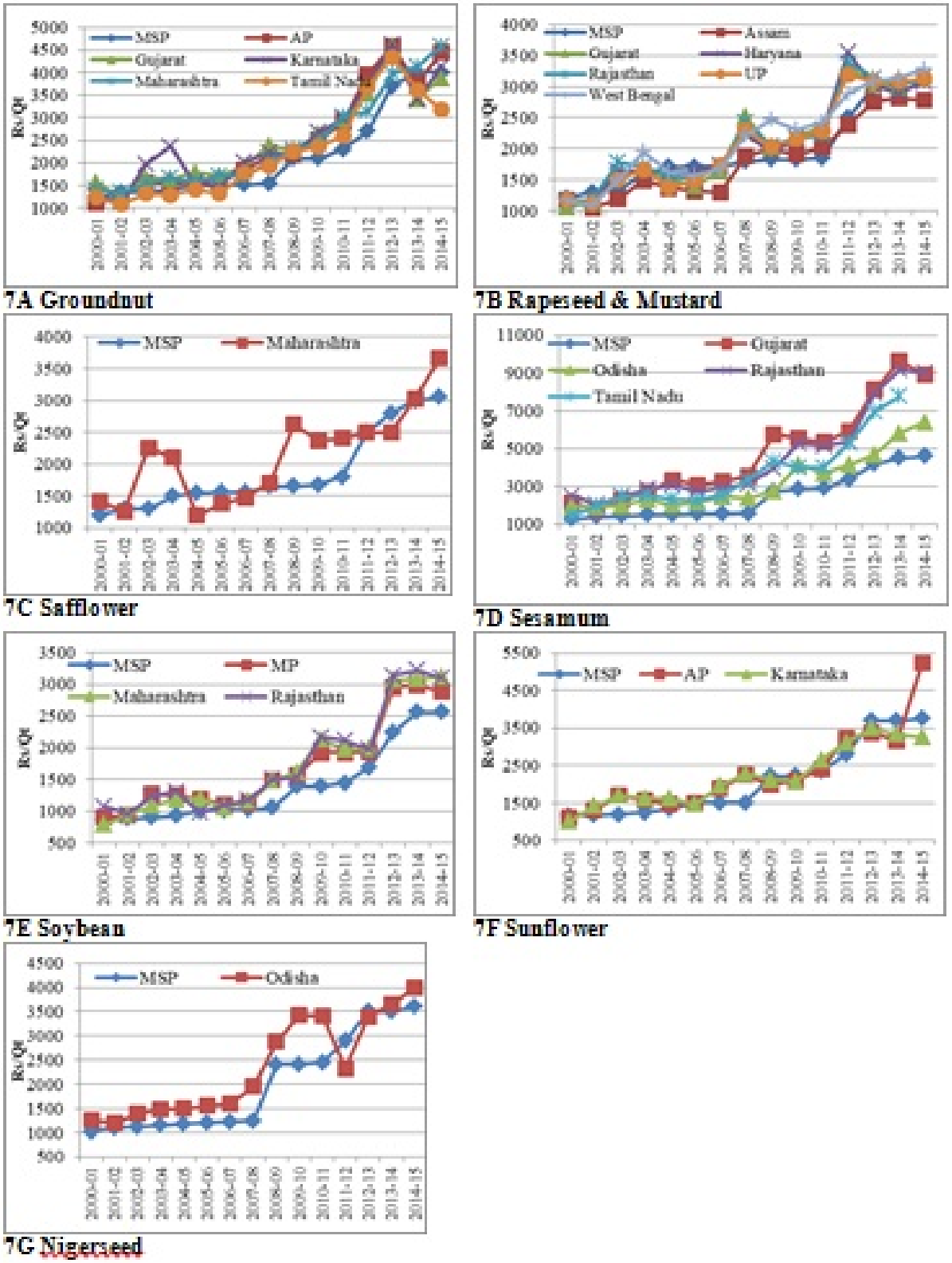

Fig. 7A to 7G. MSP and price of oilseeds in selected states at nominal prices

Annexure 1 Input use pattern in cultivation of oilseeds

Crop/State	Period	Seed (kg/ha)	Fertilizer (kg. Nutrs/ha)	Manure (Qtl/ha)	HL (Man Hrs/ha)	AL (Pair Hrs/ha)
GN_AP	2000/01-2004/05	102.27	52.73	16.74	557.94	50.98
	2010/11-2014/15	119.92	121.19	25.77	756.19	37.90
GN_Guj	2000/01-2004/05	102.82	59.14	30.22	498.03	57.28
	2010/11-2014/15	129.59	92.94	29.61	563.07	44.97
GN_Knk	2000/01-2004/05	88.28	56.03	9.47	591.48	66.83
	2010/11-2014/15	108.12	100.43	6.88	543.56	49.82
GN_Mah	2000/01-2004/05	91.50	53.50	27.08	1040.23	82.35
	2010/11-2014/15	89.23	92.17	13.82	927.97	43.35
GN_TN	2000/01-2004/05	116.88	67.87	31.96	916.18	40.84
	2010/11-2014/15	121.37	86.46	36.08	764.17	25.35
RM_Asm	2000/01-2004/05	9.82	22.95	9.67	526.69	221.47
	2010/11-2014/15	10.41	31.33	7.74	505.42	172.01
RM_Guj	2000/01-2004/05	5.18	112.97	5.01	506.73	16.96
	2010/11-2014/15	5.85	144.29	6.34	494.10	6.46
RM_Hry	2000/01-2004/05	4.52	110.79	1.31	284.28	15.09
	2010/11-2014/15	3.72	136.15	0.16	225.34	1.66
RM_Raj	2000/01-2004/05	5.79	79.97	1.07	334.61	8.05
	2010/11-2014/15	5.93	80.19	0.41	324.08	2.20
RM_UP	2000/01-2004/05	5.59	83.63	8.30	478.66	20.31
	2010/11-2014/15	5.60	113.94	0.68	421.28	9.41
RM_WB	2000/01-2004/05	7.83	99.53	8.62	680.82	111.65
	2010/11-2014/15	7.97	135.16	3.74	646.02	64.22
Sff_Mah	2000/01-2004/05	11.84	11.15	0.00	329.67	51.67
	2010/11-2014/15	14.79	41.29	0.00	445.67	49.80
Sesa_Guj	2000/01-2004/05	2.26	50.01	12.93	373.47	26.57
	2010/11-2014/15	4.80	96.31	7.40	478.62	12.74
Sesa _Ods	2000/01-2004/05	10.43	0.58	0.09	424.96	136.55
	2010/11-2014/15	10.78	4.27	0.00	400.32	89.82
Sesa _Raj	2000/01-2004/05	4.69	4.85	0.39	292.77	11.01
	2010/11-2014/15	3.97	6.04	0.21	281.17	9.99
Sesa _TN	2000/01-2004/05	6.65	36.84	2.28	466.86	23.72
	2010/11-2014/15	6.83	57.49	5.54	408.41	3.52
Soy_MP	2000/01-2004/05	93.54	41.04	5.19	340.32	48.57
	2010/11-2014/15	87.54	43.62	6.09	262.58	17.41
Soy_Mah	2000/01-2004/05	77.50	74.40	5.07	541.34	82.67
	2010/11-2014/15	77.97	79.33	8.98	446.23	53.88
Soy_Raj	2000/01-2004/05	93.77	14.39	0.36	362.30	25.77
	2010/11-2014/15	102.91	13.66	2.92	316.84	4.614
Sun_AP	2000/01-2004/05	6.93	84.89	8.87	430.77	62.70
	2010/11-2014/15	6.84	122.04	5.87	451.92	35.99
Sun_Knk	2000/01-2004/05	5.64	58.09	2.20	344.60	69.70
	2010/11-2014/15	5.48	63.43	0.73	257.90	38.59
NG_Ods	2000/01-2004/05	10.46	0.00	0.00	280.28	133.42
	2010/11-2014/15	10.03	0.00	0.00	353.38	126.62

The government also undertakes procurement of selected agricultural commodities through its procurement agencies, in order to maintain buffer stock of food-grains and in case of market prices crash for oilseeds, pulses and other commodities. However, the procurement of oilseeds was sporadic and negligible, as there was very low quantity procured as proportion of marketable surplus even on the event of market prices ruling below MSP. The procurement system for oilseeds is mostly non-existent, and thus farmers are left at the mercy of traders, who tend to pay low prices for agricultural commodities. It is evident from the figures 7.A to 7.G that the state level average price received by the farmers was even below MSP for most of the oilseed crops. To promote production of oilseeds and improve their profitability, procurement need to be ensured at MSP in all the states.

Yield gap and constraints in oilseeds production: Earlier studies (Jha *et al.,* 2012; Sharma, 2014; Sharma, 2017) have reported that there exists a large realisable yield gap in oilseed crops. The realisable yield potential in case of majority of the oilseed crops has not been achieved and there are large technology and extension gaps in the country. Average yields realised are only about 40-50 per cent, in many cases, of the potential yield. Significant gap between the maximum attainable and the farm-level yields (ranging from 10 to 30 percent) exists since long, which can be narrowed down by higher adoption of production technology by farmers. In majority of the oilseed crops there is a large scope for enhancement in productivity and therefore, efforts must be made to enhance productivity and profitability, and in turn increase farmers' income.

A study by Sharma, 2014 reported that socio-economic, biophysical, institutional and policy related, technological knowhow and market related factors were responsible for low yields of oilseed crops and large yield gaps. The study further enumerated the constraints and problems in production and marketing of oilseeds encountered by farmers hindering the productivity and profitability as lack of suitable varieties and availability of quality seeds, high-costs and timely availability of inputs, increasing incidence of diseases and insect pests, low and fluctuating prices, shortage of human labour, poor irrigation facilities, weak linkages between oilseed producers and processors and markets leading to exploitation by market intermediaries, poor extension services, etc.

The abovementioned study recommended that for achieving higher yield and profitability from oilseeds, balanced and integrated crop nutrition, mechanization, and timely availability of quality inputs including seeds of improved varieties need to be ensured and it should be complemented with effective market interventions through price support and effective procurement and strengthening market infrastructure. Efforts are to be diverted to promote water use efficiency through protective irrigation and a well-functioning, adequately funded and well-coordinated agricultural extension services in order to enhance productivity of oilseeds and improve income of oilseed producers. Efficient mechanism for yield and price risk management is of paramount importance, reach of which needs to percolate to the needy farmers.

Conclusions: Indian agriculture is undergoing a considerable change as the focus of government is on improving profitability and in turn farmers' income from the crops and the sector, and to ensure this, government has started numerous schemes. Oilseeds are of paramount importance for national economy as well as for the farmers' income, as the crops support income of farmers mainly in the rainfed/dryland areas. The present study has analysed the changes in income from oilseeds in the selected states in India, using data from Cost of Cultivation Surveys. The analysis revealed that net income as well as farm business income has increased in the states with higher proportionate rise in crop yield and/ or price realized by farmers as compared to increase in input cost. The decline in income from oilseeds crops was observed in the states where input costs have increased faster than the increase in yield or price of the crop or in the states where yields have not improved or rather decreased.

The major factors affecting the profitability of oilseeds include the level of productivity of crop, changes in input cost and price realized by farmers. Oilseeds are grown under rainfed ecosystem on marginalized lands with minimum use of productive and protective inputs leading to low average productivity. The real minimum support price for oilseeds has not increased and there is minimal procurement support for these crops. The average yield at state or national level is well below the achievable yield potential of oilseed crops. This large gap can be narrowed down through ensuring quality input supply at affordable prices, increase adoption of production technology and price support with effective procurement. Concerted efforts are to be directed to improve the efficiency of water use through protective irrigation, enhance the effectiveness of extension services to increase productivity and profitability, which will bolster the farmers' income.

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