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# Publication trends of Groundnut and Mustard research in India: A scientometric study

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## Abstract

The main objective of this paper is to find out the publication activity in groundnut and mustard research in the world. This paper analyses 7463 papers published during 14 years (2000 -2013). Yearly activity index of India have been calculated. Reports that journals have been used to publish 97.92% of research publications. Relative growth rate and doubling time have decreased from 2000 to 2013. Authorship pattern shows 92.74 % of papers published in collaboration.

**Keywords:** Bibliometric study, Oilseeds research, Groundnut research, Mustard research, Activity Index, Relative Growth Rate, Authorship Pattern

## 1 Introduction

Oilseeds are playing very important role in Indian agricultural economy. India stands fourth largest vegetable oil economy whereas U.S.A. holds first, China on second and Brazil on third place. Indian domestic consumption of edible oils have increased day by day and imported 12.4 million metric tons edible oils in the year 2014 (USDA Foreign Agriculture Service, 2014). The sources of vegetable oils are groundnut, rapeseed-mustard, soybean, safflower, sunflower, sesame, niger, linseed and castor, etc. In India, Soybean (39%), groundnut (26%), and rapeseed-mustard (24%) contribute 88% of total oilseeds production. All other edible oils like palm oil, sunflower oil, sesame oil, contribute rest share (11%) of oilseeds production (India. Ministry of Agriculture status report on oilseeds, 2014). There are many databases which provide agricultural data. CAB Direct is one of the leading database services provided by



Commonwealth Agriculture Bureaux International. It is a non-for-profit inter-governmental organization based in United Kingdom. It was established as Commonwealth Agriculture Bureaux in 1910 (CAB Direct)

## 2 Review of literature

Reviews many papers on publication trends in many subjects e.g. Kumar et al (2011) have attempted to highlight quantitatively the growth and development of world literature on nuclear waste management based on International Nuclear Information System (INIS) database for the period 1970–2009. Gopalakrishan (2013) has conducted bibliometric study of global literature output in the field of textile research for the period of 30 years (1983-2012). Relative growth rate and doubling time of textile literature have been calculated. India contributed 5.2% of total world research output on textile and secured fourth rank in study duration. The study by Bala and Gupta (2010) have attempt to analyze biochemistry, genetics and molecular biology research in India during 1998–2007 from *Scopus* database. The study focuses on the research output, publication share, countries rank and growth rate of India's publication productivity. Khatun and Ahmed (2011) have presented quantitative analysis to identify the literature growth, publication pattern and journal distribution on diarrhoeal disease research in Bangladesh based on data obtained from Pub-med, Web of Science and *Scopus* databases. Varaprasad and Ramesh (2011) have discussed activity and growth of chemical research in India during 1987–2007 using *Scopus* database. A few papers are on oilseeds e.g. Kumar and Kumar (2004) on prodoctometric study of scientists of NRCS, Kumar and Kumar (2011) on Journal of Oilseeds in important journals. Many papers on oilseeds have been presented in reputed conferences (Kumar and Kumar , 2008) on collaboration pattern on oilseeds research institutes, productivity of scientists of NRCS and collaboration in DSR are with mentioning.

## 3 Methodology

Data has been collected from CAB Direct available at Directorate of Soybean Research, Indore (M.P.). The data is collected by the terms 'groundnut' and 'rapeseed-mustard', 'Arachis Hypogaea' and 'Brassica' etc. for the duration of 14 years (2000 -2013). Brassica compestris is rapeseed in English name while sarson and toria are common name. On the other hand Brassica juncea is known as mustard in English and Rai as common name. But in India, commonly mustard is known as sarson and rapseed (sarson) is also known as sarson. Thus, mustard is common name for rapeseed (sarson) and mustard (rai) & both are used in oil extraction. The data has been transferred to M S Excel for further tabulation and statistical analyses.

## 4 Hypothesis

To test the performance of research activity on India in the subject following hypothesis have been prepared and tested in this study.

1. Activity index of India is high.
2. Relative growth rate of world has decreasing trend and consequently doubling time has increasing trend.

## 5 Methodology

Publication trend of world groundnut research have been measured on many scientometrics parameters. For the purpose of analysing research publication activity following statistical formulae have been used:

### a Activity index:

$$\text{A.I.} = \frac{\text{Given field's share in the country's publication output}}{\text{Given field's share in the world's publication output}} \times 100$$

e.g. In this study for the year 2000

$$\text{A.I.} = \frac{562/7463}{1249/22968} \times 100$$

$$\text{A.I.} = \frac{0.45}{0.32} \times 100$$

$$\text{A.I.} = 140.61\%$$

### b. Relative growth rate and doubling time:

$$\text{RGR} = \frac{\text{Log}_e 2w - \text{Log}_e 1w}{2^T - 1^T}$$

Where,  $\text{Log}_e 1w$  = log of initial number of articles;  $\text{Log}_e 2w$  = log of final number of articles after a specific period of interval;  $2^T - 1^T$  = the unit difference between the initial time and the final time

$$\text{DT} = \frac{\text{Log}_e 2}{\text{GR}}$$

Where, DT =Doubling Time, GR = Growth rate;  $\text{Log}_e 2 = 0.693$

## 6 Analysis

The data have been analysed with the help of M S Excel. The analysis shows that 98% papers covered in the database are in journals in this study. Yearly distribution shows an average 533 research papers for the oilseeds.

## 6.1 Yearly distribution

Table 1 presents year wise distribution of contributions in groundnut and mustard with their percentages. Total 3875 (51.92%) records published in groundnut research and 3588 (48.07%) records in mustard collected in the year 2000 to 2013. There is not much difference in the number of research publications of both the oilseeds. This is also shown in graph 1.

Table 1  
Yearly distribution of groundnut and mustard research in India

| S. N. | Year           | Groundnut | Mustard | Total (combined) |
|-------|----------------|-----------|---------|------------------|
| 1     | 2000           | 329       | 233     | 562              |
| 2     | 2001           | 300       | 220     | 520              |
| 3     | 2002           | 305       | 297     | 602              |
| 4     | 2003           | 226       | 296     | 522              |
| 5     | 2004           | 281       | 265     | 546              |
| 6     | 2005           | 299       | 314     | 613              |
| 7     | 2006           | 243       | 249     | 492              |
| 8     | 2007           | 272       | 258     | 530              |
| 9     | 2008           | 286       | 259     | 545              |
| 10    | 2009           | 280       | 241     | 521              |
| 11    | 2010           | 319       | 229     | 548              |
| 12    | 2011           | 240       | 223     | 463              |
| 13    | 2012           | 254       | 263     | 517              |
| 14    | 2013           | 241       | 241     | 482              |
|       | <b>Total</b>   | 3875      | 3588    | 7463             |
|       | <b>Average</b> | 276.8     | 256.3   | 533.1            |

## 6.2 Activity index

In the study, total publications of groundnut and mustard research in the world are 22968 out of which India accounts for highest 7463 records (30%) in 95 countries in the research. Table 2 shows calculated Activity Index (AI) of India in the world. The value of AI has decreased from 140.61 % to 73.94% over the years. It has fallen year by year continuously as shown in graph 1 also.

Table 2  
Activity index of India in the world

| S. N. | Year | Indian publications | World publications | AIP  | AI      |
|-------|------|---------------------|--------------------|------|---------|
| 1     | 2000 | 562                 | 1249               | 0.45 | 140.61% |
| 2     | 2001 | 520                 | 1299               | 0.40 | 125.10% |
| 3     | 2002 | 602                 | 1514               | 0.40 | 124.26% |

|    |              |      |       |             |                |
|----|--------------|------|-------|-------------|----------------|
| 4  | 2003         | 522  | 1385  | 0.38        | 117.78%        |
| 5  | 2004         | 546  | 1484  | 0.37        | 114.98%        |
| 6  | 2005         | 613  | 1621  | 0.38        | 118.18%        |
| 7  | 2006         | 492  | 1496  | 0.33        | 102.77%        |
| 8  | 2007         | 530  | 1677  | 0.32        | 98.76%         |
| 9  | 2008         | 545  | 1731  | 0.31        | 98.39%         |
| 10 | 2009         | 521  | 1693  | 0.31        | 96.17%         |
| 11 | 2010         | 548  | 1832  | 0.30        | 93.48%         |
| 12 | 2011         | 463  | 1876  | 0.25        | 77.13%         |
| 13 | 2012         | 517  | 2074  | 0.25        | 77.90%         |
| 14 | 2013         | 482  | 2037  | 0.24        | 73.94%         |
|    | <b>Total</b> | 7463 | 22968 | <b>0.32</b> | <b>104.25%</b> |

# AIP= Average Indian publication, AI= Activity index

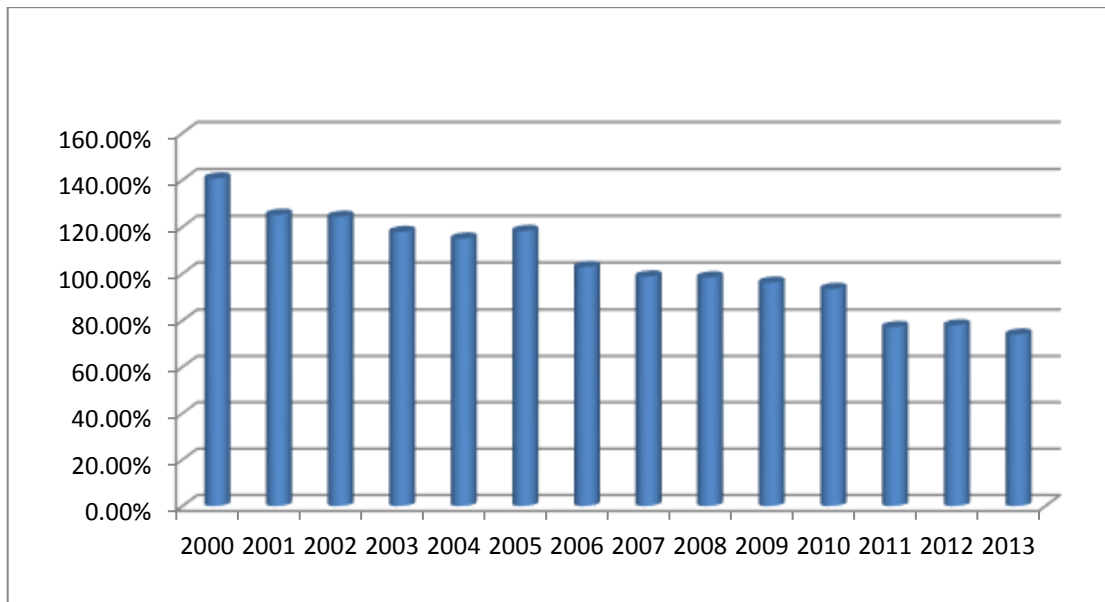


Figure 1: AI of India in groundnut and mustard research in the world

### 6.3 Relative growth rate and doubling time

Table 3 shows the relative growth rate (RGR). It has continuously decreased from 0.66 to 0.07 in the duration of 2001 to 2013 and consequently the doubling time has increased from 1.06 in year 2001 to 10.38 in year 2013. This is also reflected in Figures 2 and 3.

Table 3

Relative growth rate and doubling time of groundnut and mustard research in India

| S.N. | Year | Total* | CT** | W1   | W2   | RGR  | DT    |
|------|------|--------|------|------|------|------|-------|
| 1    | 2000 | 562    | 562  |      | 6.33 |      |       |
| 2    | 2001 | 520    | 1082 | 6.33 | 6.99 | 0.66 | 1.06  |
| 3    | 2002 | 602    | 1684 | 6.99 | 7.43 | 0.44 | 1.57  |
| 4    | 2003 | 522    | 2206 | 7.43 | 7.70 | 0.27 | 2.57  |
| 5    | 2004 | 546    | 2752 | 7.70 | 7.92 | 0.22 | 3.13  |
| 6    | 2005 | 613    | 3365 | 7.92 | 8.12 | 0.20 | 3.45  |
| 7    | 2006 | 492    | 3857 | 8.12 | 8.26 | 0.14 | 5.08  |
| 8    | 2007 | 530    | 4387 | 8.26 | 8.39 | 0.13 | 5.38  |
| 9    | 2008 | 545    | 4932 | 8.39 | 8.50 | 0.12 | 5.92  |
| 10   | 2009 | 521    | 5453 | 8.50 | 8.60 | 0.10 | 6.90  |
| 11   | 2010 | 548    | 6001 | 8.60 | 8.70 | 0.10 | 7.24  |
| 12   | 2011 | 463    | 6464 | 8.70 | 8.77 | 0.07 | 9.32  |
| 13   | 2012 | 517    | 6981 | 8.77 | 8.85 | 0.08 | 9.01  |
| 14   | 2013 | 482    | 7463 | 8.85 | 8.92 | 0.07 | 10.38 |

\*Total= sum of groundnut and mustard research, \*\* CT= cumulative total

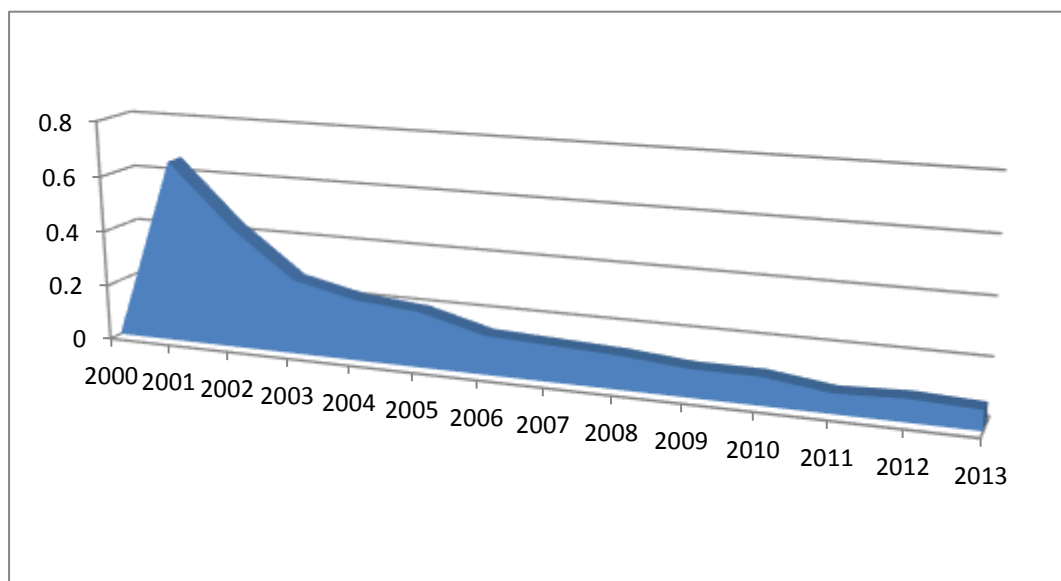


Figure 2: Relative Growth Rate

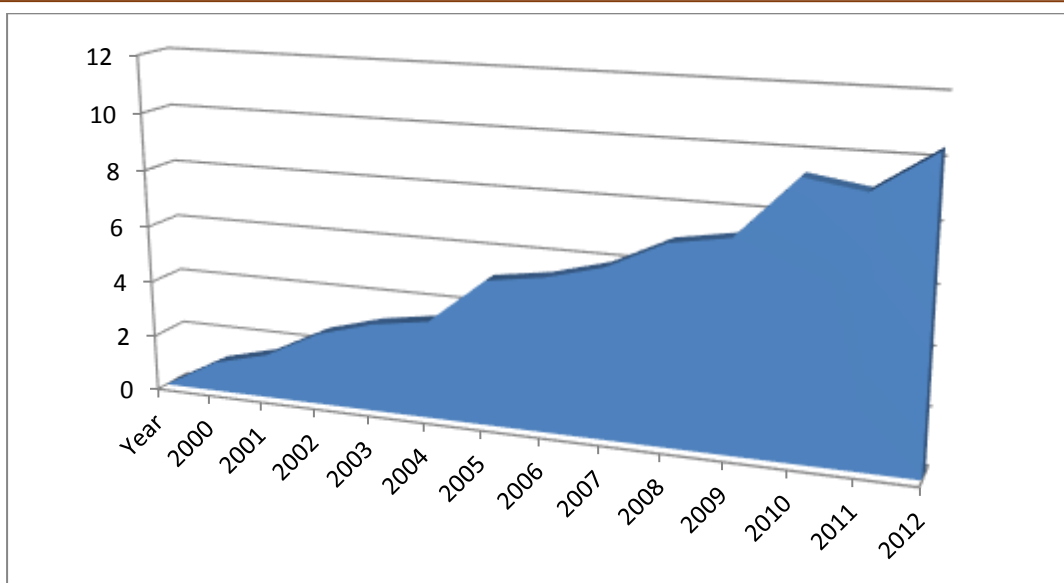


Figure 3: Doubling Time

### 6.4 Medium of communication and authorship pattern

Some basic facts on this research such as channels of communication and authorship pattern as follows have also been provided below:

#### 6.4.1 Communication channels

Table 4 provides list of communication channels used for publication of research work by the scientists on this topic. Journals are the most popular communication channels used for research publications with 7308 (97.92%) papers. Other communication channels have only 155 (2.02%) papers. This is also shown in Figure 4.

Table 4  
Communication channels of groundnut and mustard research in India

| Year | Journal articles | Conference papers | Book & book chapters | Bulletins | Miscellaneous | Total | %     |
|------|------------------|-------------------|----------------------|-----------|---------------|-------|-------|
| 2000 | 549              | 4                 | 2                    | 0         | 7             | 562   | 7.53% |
| 2001 | 507              | 2                 | 6                    | 0         | 5             | 520   | 6.97% |
| 2002 | 572              | 18                | 6                    | 0         | 6             | 602   | 8.07% |
| 2003 | 509              | 7                 | 4                    | 0         | 2             | 522   | 6.99% |
| 2004 | 528              | 5                 | 6                    | 1         | 6             | 546   | 7.32% |
| 2005 | 609              | 0                 | 2                    | 0         | 2             | 613   | 8.21% |
| 2006 | 473              | 15                | 0                    | 0         | 4             | 492   | 6.59% |
| 2007 | 523              | 4                 | 1                    | 0         | 2             | 530   | 7.10% |
| 2008 | 540              | 1                 | 2                    | 0         | 2             | 545   | 7.30% |
| 2009 | 506              | 14                | 0                    | 0         | 1             | 521   | 6.98% |
| 2010 | 546              | 1                 | 0                    | 0         | 1             | 548   | 7.34% |

|              |               |              |              |              |              |                |                |
|--------------|---------------|--------------|--------------|--------------|--------------|----------------|----------------|
| 2011         | 457           | 1            | 0            | 2            | 3            | 463            | 6.20%          |
| 2012         | 510           | 3            | 0            | 2            | 2            | 517            | 6.93%          |
| 2013         | 479           | 1            | 0            | 0            | 2            | 482            | 6.46%          |
| <b>Total</b> | <b>7308</b>   | <b>76</b>    | <b>29</b>    | <b>5</b>     | <b>45</b>    | <b>7463</b>    | <b>100.00%</b> |
| <b>%</b>     | <b>97.92%</b> | <b>1.02%</b> | <b>0.39%</b> | <b>0.07%</b> | <b>0.60%</b> | <b>100.00%</b> |                |

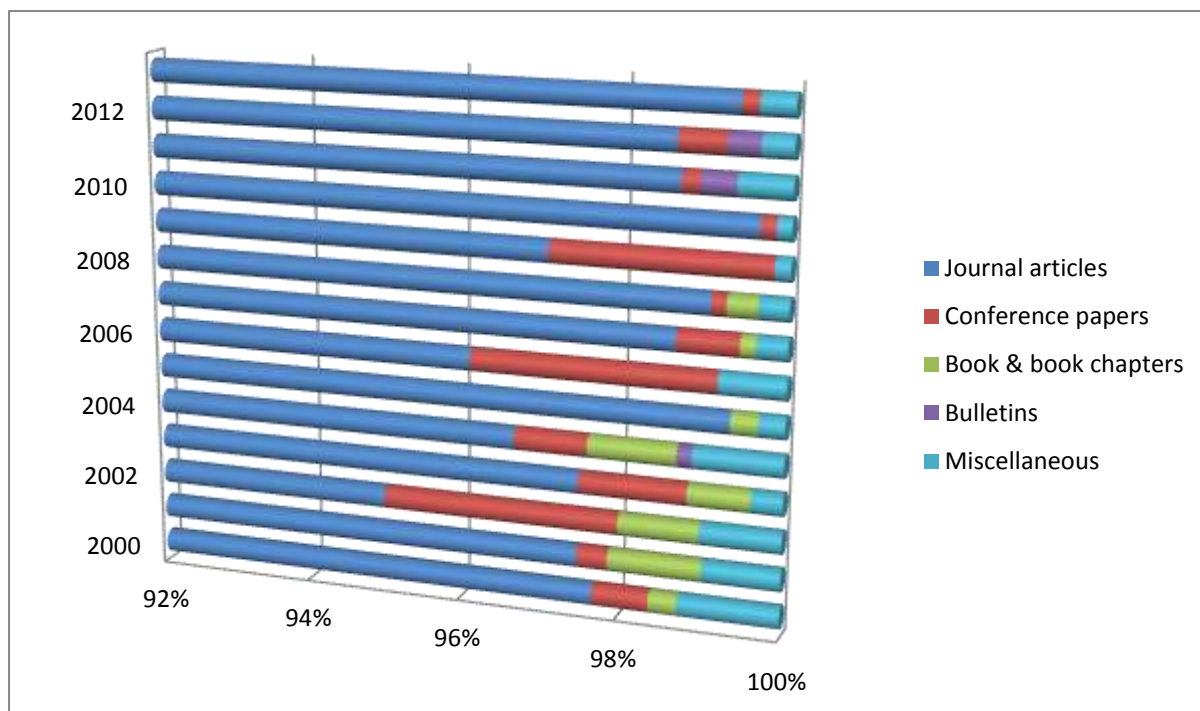


Figure 4: Communication channels

**6.4.2 Authorship pattern**

Table 5 provides collaboration pattern in research articles. Only 542 (7.26%) articles have been published by single authors, whereas 6921 (92.73%) articles have published in co-authorship. Out of these, 5730(76%) papers have been published by two, three and four authorship. Nearly 1191(15.95%) articles have been published by five to twenty authors. It can be inferred that joint- authorship is popular in authorship pattern in research publications and single author articles have almost vanished in the research. It is also shown in chart 5.

**Table 5**  
**Author wise distribution of groundnut and mustard research in India**

| S.N. | Year | Single author | Two authors | Three authors | Four authors | Five authors | VI and more authors | Total | %     |
|------|------|---------------|-------------|---------------|--------------|--------------|---------------------|-------|-------|
| 1    | 2000 | 45            | 173         | 193           | 100          | 24           | 27                  | 562   | 7.53% |
| 2    | 2001 | 50            | 174         | 152           | 85           | 30           | 29                  | 520   | 6.97% |
| 3    | 2002 | 51            | 190         | 179           | 110          | 46           | 26                  | 602   | 8.07% |



|    |              |              |               |               |               |              |              |                |                |
|----|--------------|--------------|---------------|---------------|---------------|--------------|--------------|----------------|----------------|
| 4  | 2003         | 44           | 153           | 169           | 90            | 33           | 33           | 522            | 6.99%          |
| 5  | 2004         | 47           | 157           | 169           | 98            | 43           | 32           | 546            | 7.32%          |
| 6  | 2005         | 40           | 175           | 200           | 112           | 42           | 44           | 613            | 8.21%          |
| 7  | 2006         | 31           | 132           | 159           | 92            | 46           | 32           | 492            | 6.59%          |
| 8  | 2007         | 35           | 138           | 184           | 93            | 45           | 35           | 530            | 7.10%          |
| 9  | 2008         | 31           | 117           | 180           | 129           | 60           | 28           | 545            | 7.30%          |
| 10 | 2009         | 30           | 135           | 161           | 101           | 47           | 47           | 521            | 6.98%          |
| 11 | 2010         | 30           | 138           | 167           | 114           | 62           | 37           | 548            | 7.34%          |
| 12 | 2011         | 38           | 100           | 118           | 110           | 55           | 42           | 463            | 6.20%          |
| 13 | 2012         | 30           | 116           | 136           | 88            | 59           | 88           | 517            | 6.93%          |
| 14 | 2013         | 40           | 115           | 125           | 103           | 45           | 54           | 482            | 6.46%          |
|    | <b>Total</b> | <b>542</b>   | <b>2013</b>   | <b>2292</b>   | <b>1425</b>   | <b>637</b>   | <b>554</b>   | <b>7463</b>    | <b>100.00%</b> |
|    | <b>%</b>     | <b>7.26%</b> | <b>26.97%</b> | <b>30.71%</b> | <b>19.09%</b> | <b>8.54%</b> | <b>7.42%</b> | <b>100.00%</b> |                |

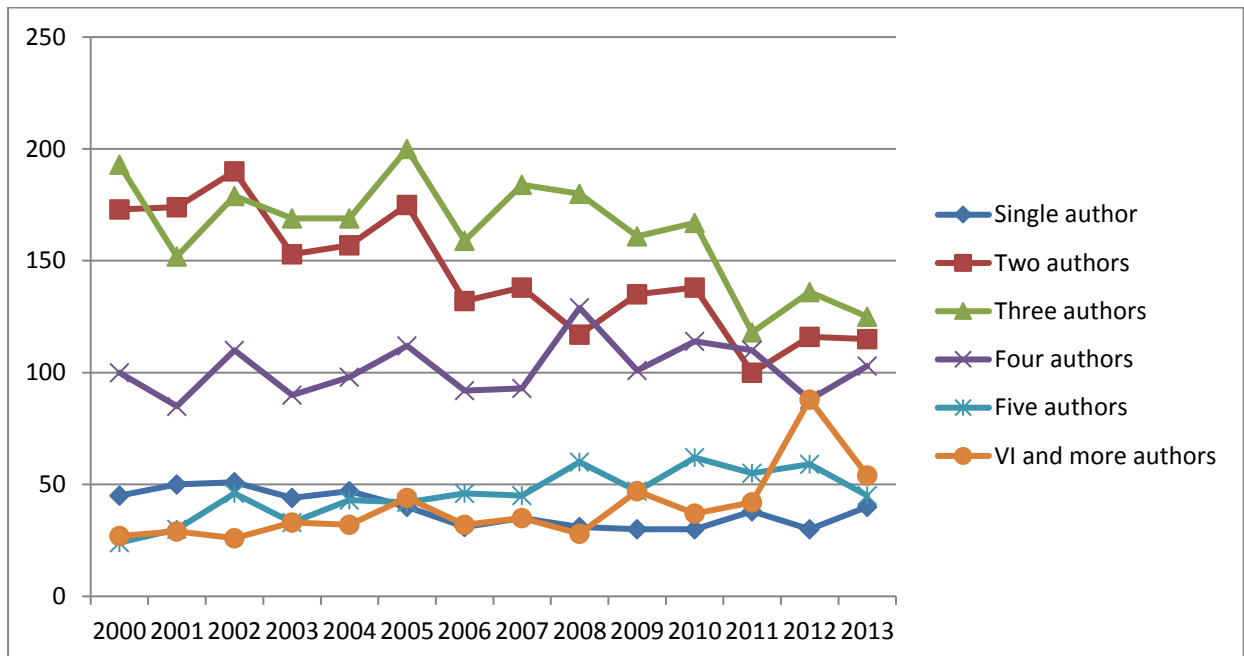


Figure 5: Authorship pattern

## 7 Testing of hypothesis

These hypotheses have been tested to evaluate the performance of research activity in India as follows:

### 7.1 Activity index of India is high.

The activity index of India has been decreased from 140.61 % to 73.94%. The activity index has decreased 67% in 14 years.

Presumed mathematically as:

$$H_0: A. I. \geq 100\%$$

$$H_1: A. I. < 100\%$$

To test the hypothesis t- test has been applied.

For this, mean and S.D. have been calculated as per formula values.

Calculated mean = 104.25%,

Hypothes mean = 100,

S.D. = 41.53,

n = 14,

Tabulated t value on 0.05 significance level for degree of freedom (14-1) = 1.771  
(as per standard table)

t-test value:

$$t = \frac{104.25 - 100}{41.53 / \sqrt{14}} = 0.38$$

Here  $0.38 < 1.771$

That is calculated t value is less than tabulated t value.

**So, the hypothesis is accepted.**

Indian activity index is very high in the world. This activity index revealed that the Indian scientists are very active in this research field.

## **72. Relative growth rate of India has a decreasing trend and consequently doubling time has increasing trend.**

Table 3 found a continuously decreased in RGR from 2000 to 2014, and as the RGR has decreased doubling time of research publications has increased year by year.

**So, the hypothesis is accepted.**

## **8 Conclusion**

The study presents evaluation of the groundnut and mustard research outputs on different parameters and finds out that research publications in Indian (groundnut and mustard) research have continuously but slowly decreasing trend. India has high activity index but has a decreasing trend. Relative growth rate of research publications have decreased year by year consequently doubling time have increased. Since the demand of edible oils is still high and ever increasing, the research activity will have to be increased to increase per hac. yield, especially in developing countries like India which still depends on its imports.



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