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# GREEN REVOLUTION AND ITS IMPACT ON PRODUCTION OF OILSEEDS IN INDIA

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**Abstract**

The purpose of this paper is to analyse the impact of Green revolution on the production of Oilseeds as from the inception of independence the foremost view of the government was how to come out from the trap of severe food crisis by removing the prevailing for ever stagnant situation in agriculture. In this study to deliberate the impact of 'Green Revolution' on area under cultivation, production and yield during the period of 1950 to 2015 in case of Nine Oilseeds and Rapeseed and Mustard, the 'Spline Function' technique has been taken into consideration which is estimated by simple least square method. The preferred time period is, also divided into three regimes, such as pre Green Revolution (1950-65), first phase of Green Revolution (1965 to 1985) and second phase of Green Revolution (1985-2015).

It is found that there is a sharp increase of average area and yield nearly more than two times where as average production has grown up greater than five times for Rapeseed and Mustard in the second phase of Green Revolution. In case of Nine Oil Seeds average area and production also have raised greater than two times. Again the growth rate of both production and productivity has increased significantly for Rapeseed and Mustard during the first phase of Green Revolution almost more than two times. But the growth rate of production and yield of Rapeseed and Mustard have diminished insignificantly during the second phase of Green Revolution or in the regime of Technology Mission on Oilseeds (TMO). This paper has revealed that the seed-water-fertiliser technology cannot sustain the agricultural development with economic development alone if the vital issues (crop diversification, crop insurance, multi-cropping facility, proper marketing system etc.) relating to the problems of farmers are not solved.

**Key words:** **Green Revolution, Technology mission on Oilseeds**

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## 1. Introduction

After independence, the government implemented different economic plans time to time for coming out of the current and future numerous problems faced by our economy. For achieving this target, the government had started its journey by incorporating the first five year economic plan from 1951 to 1956 and its main focus was how to solve the sever food crisis faced by the people of our country. In this regard government considered the agriculture as a priority sector of this plan and had taken various steps in favour of rapid agricultural development for attaining food self-sufficient within the shortest possible time. In this plan out of the different non-food grains, the actual production of oilseeds (5.6 million tonnes) was in second position that is just after sugarcane (60 million tonne) (Economic Survey 2013-14). But at the end of this plan it is observed that the actual production of food-grains exceeded the targeted production (actual production-67 million tonne and targeted production-62). On the other hand out-of other non food-grains only the actual production of oilseeds though exceeded the target production (actual production-5.6 million tonne and targeted production-5.5 million tonne) it was moderated. From this information the truth comes out that the agriculture still was in bad and unforgivable situation. The remarkable points behind the above condition were indebtedness among the farmers, small, fragmented and scattered holding, lack of knowledge for using equipments, insufficient better quality of seeds and chemical fertilisers.

The government had given special emphasis as a top priority sector on the agriculture via introducing the seeds-water-fertilisers technology in the third five year economic plan. It is commonly and popularly known as a 'Green Revolution' and started its forwarding step from mid of 1960's. As per the policy makers, with the help of this technology the farmers will be able to produce multiple crops at a short duration on the same land. This was the first phase of Green Revolution. In this phase the yield rate per hectare for all crops (data) has been increased steadily and continuously. However from the comparative analysis of success and failure of first 'Green Revolution', it is observed that it was few regions and crops centric (Singh (1974), Subramaniam (1979), Brahmanand (2000)). Besides Ex-Prime minister Manmohan Singh pointed out two demerits regarding failure of first 'Green Revolution', such as, (i) it did not benefit dry-land farming and (ii) it was not scale neutral and had thus benefited only large farms and big farms (Dutta and Sundharam's, India Economy, 2015). Therefore, the government had taken few

technical steps to sustain the agricultural development all over country for all crops such as, Price policy based on Minimum Support Price (MSP) and procurement operations, infrastructure for storage/cold storage, increase in investments, expansion in supplies of inputs and services to farmers, agricultural extension and better management. Which is broadly called as Second Green Revolution started from 1983-84 (K.R.Gupta and J.R.Gupta, Indian Economy Vol.-I, Published by Atlantic Publisher and Distributor (p) Limited, 2008; and G. Datta and K.P.M. Sundharam's, Indian Economy, 71st Edition, published by S. Chand & Company Pvt. Ltd, 2015; M.Pd.Shrivastava, et al Second Green Revolution Vs. Rainbow Revolution, Deep & Deep Publication Pvt. Ltd. 2010). It breaks out in eastern and central states including West Bengal, Bihar, Orissa, Madhya Pradesh and eastern U.P. All these states had shown a tremendous step forward in recent years. Here for analytical simplicity I consider the period from 1985 to 2015 (1985-2015) as the second phase of Green Revolution.

The government implemented the National Oilseed Development Project in 1985-86 for removing the unfavourable situation in oilseeds production. In the same year (May 1986) the government had taken an action, the technology mission on oilseeds (TMO). Its objective is to increase the production and productivity of oilseeds for making the country self-sufficient in this field. Again the government introduced the National Agricultural Policy, 2000 (NAP, 2000) for achieving the agricultural growth at a level which is sustainable technologically, environmentally and economically. Further in 2004, the TMO policy has been modified by the government and called in new name as Integrated Scheme of Oil seeds, Pulses, Oil palm and Maize (ISOPOM) for getting effective and fruitful results of the said scheme.

The occupied gross cropped area under oilseeds is the highest and in prominent position among non-food grains in Indian economy (Economic Survey 2014-15). It accounts near about 14 per cent of the gross cropped area in the country (Impact Assessment of Trade Liberalization in Oilseeds Sector: A Case Study of Rajasthan; Researched and Written by: Dr. N C Pahariya). India also captures the fourth position in terms of the largest producer of vegetable Oil into the scenario of world economy just after USA, China and Brazil. It contributes about 10 per cent of the world oilseeds production, 6-7% of the global production of vegetable oil, and nearly 7 percent of protein meal (V.P. Sharma (November 2014), "Problem and prospects of Oilseeds

Production in India (Final Report)). The coverage area, however under Oilseeds has increased from 13.77 (1960-61) to 27.22 (2010-11) million hectares, and total production has gone up extensively from 6.98 (1960-61) to 32.43 (2013-14) million tonnes that is, more than five times. Similarly the total area under Rapeseed and Mustard has enlarged from 2.88 (1960-61) to 6.90 (2010-11) million hectares. Again the total production has reached from 1.35 (1960-61) to 8.18 (2010-11) million tonnes, that is, more than seven times (Agricultural Statistics Division, Directorate of Economics & Statistics, Government of India). But, at a glance from the statistical information of various issue of economic survey published by Indian Government it is proved that the purpose of extensive programme of agricultural development of the Government was not satisfactory, whereas the intensive strategy relatively has been succeeded.

For sustaining the agricultural production at a faster rate within the shortest possible time and to strengthen the linkage effect with industry, the government launched as a new technique in the field of agriculture which is widely known as Green Revolution. In this circumstance few outstanding and noticeable research studies have been remarked that the green revolution has brought a significant change in the economic scenario of rural people and encouraged them to use HYV technology in agriculture in favour of better farming to achieve self sufficiency in food grains (Bardhan (1970), Castillo.et al (1971), Byers (1972), Sen (1974), Sondhi and Singh (1974), Subramaniam (1979), Brahmanand (2000)). Besides, about this agricultural revolution a list of studies has been opined that it negatively affected the environment (Shiva (1989), Hashmi (1994), Nellithanam (1997), Husain (2002)). Once more research analysis (Maheshwari (1998)) regarding the effect of Green Revolution on cereals has pointed out that the growth rate of yield (cereals-Rice, Jowar and Ragi) was stagnant during the second phase of green revolution in the state of Karnataka. The analysists Thakur and Padmadeo (2008) noticed that the society will be helpful for generating massive employment opportunity in rural area with support of the second Green Revolution. Hegde (www.baif.org.in) stated that first Green Revolution succeeded to boost the agriculture sector in our country. Besides he also remarked that to overcome the stagnant growth condition and side by side for sustaining the agricultural development another Revolution that is the second Green Revolution is necessary. In this platform, another important article on “Oilseeds Production: Technology Mission, Growth Rate and other Details” (http://www.gktoday.in/isopom) showed that the annual average compound growth rates of area,

production and yield rate of Oilseeds have been raised. Another studied (Sharma, 2014) pointed out that the instability in production is the highest and followed by productivity of oilseeds.

## 2. Objective

The several varieties of Oilseeds are cultivated by the farmers, such as, Groundnut, Rapeseed & Mustared, Castor seed, Sesamum, Nigerseed, Linseed, Safflower, Sunflower and Soybean. It is noticed that eighty eight percent (88%) of total Oilseeds production has been under controlled the three major Oilseeds namely Groundnut, Soybean, and Rapeseed & Mustard during 2011-12 (V.P. Sharma (November 2014), "Problem and prospects of Oilseeds Production in India (Final Report)). Out of them, in our country, the Rapeseed and Mustard is the second key Oilseed crop.

On the basis of above stated review of literatures, in this research article the impact of green revolution on production of Nine Oilseeds and Rapeseed & Mustard during 1950 to 2015 has been studied. The entire selected time period is divided into three phases namely, (i) pre-green revolution phase (1950-51 to 1964-65), (ii) first phase of green revolution (1965-66 to 1984-85) and (iii) second phase of green revolution (1985-86 to 2014-15). For justifying the objective, the supporting suitable datas have been gathered from several issues of Economic Survey's Statistical Appendix, Agricultural Statistics at a Glance and also from published data of the Department of Agriculture & Cooperation of Indian Government.

## 3. Methodology

To analyse the impact of Green Revolution (GR) on area, production and yield rate in different regimes (phases), the 'Spline Function' has been chosen which was developed by Poirier in 1974.

Therefore, following three linear trend equations have been fixed corresponding to different regimes;

Regime 1: $\ln Y_t = \alpha_1 + \beta_1 t + u_t$ for $t \leq 1965$ pre-green revolution period

Regime 2: $\ln Y_t = \alpha_2 + \beta_2 t + u_t$ for $1966 < t \leq 1985$ first phase of green revolution

Regime 3: $\ln Y_t = \alpha_3 + \beta_3 t + u_t$ for $1986 < t \leq 2015$ second phase of green revolution

Also the three important weighted variables have been defined in below

$$w_{1t} = t;\ w_{2t} = \begin{cases} 0 \\ t-1966 \end{cases} \text{if,} \begin{matrix} t \le 1966 \\ 1966 < t \end{matrix};\ w_{3t} = \begin{cases} 0 \\ t-1986 \end{cases} \text{if,} \begin{matrix} t \le 1986 \\ 1986 < t \end{matrix} \quad (2)$$

and reparameterise the function as

$$\ln Y_t = \alpha_1 + \delta_1 w_{1t} + \delta_3 w_{3t} + u_t \quad (3)$$

The expression $\left[\exp(\beta_1) - 1\right]100$ will yield the percentage growth rate for the i-th regime (i=1,2,3), where $\beta_1 = \delta_1$, $\beta_2 = \delta_1 + \delta_2$ and $\beta_3 = \delta_1 + \delta_2 + \delta_3$.

The equation (3) will be used for the calculation of the growth rates of preffered varables such as area, production and yield of our selected crops (non food-grains).

## 4. Empirical Results

Refer to table-I, it is observed that the average area, production and yield of Rapeseed & Mustard and also Nine Oilseeds have been increased in the first and second phase of Green Revolution which may hopeful to the planners. In average, the area and yield both have been gone up more than twice and production has been raised beyond five times for Rapeseed & Mustard in the second regime of green revolution (1985-2015). On the other hand, at the same regime, in case of Nine Oil Seeds area and productivity also have been increased more than twice but the production has come up in excess of four times. Therefore it is said that the purpose/action behind second Green Revolution or the objective of both the Technology Mission on Oilseeds (TMO) and New Agricultural Policy quite may be succeeded.

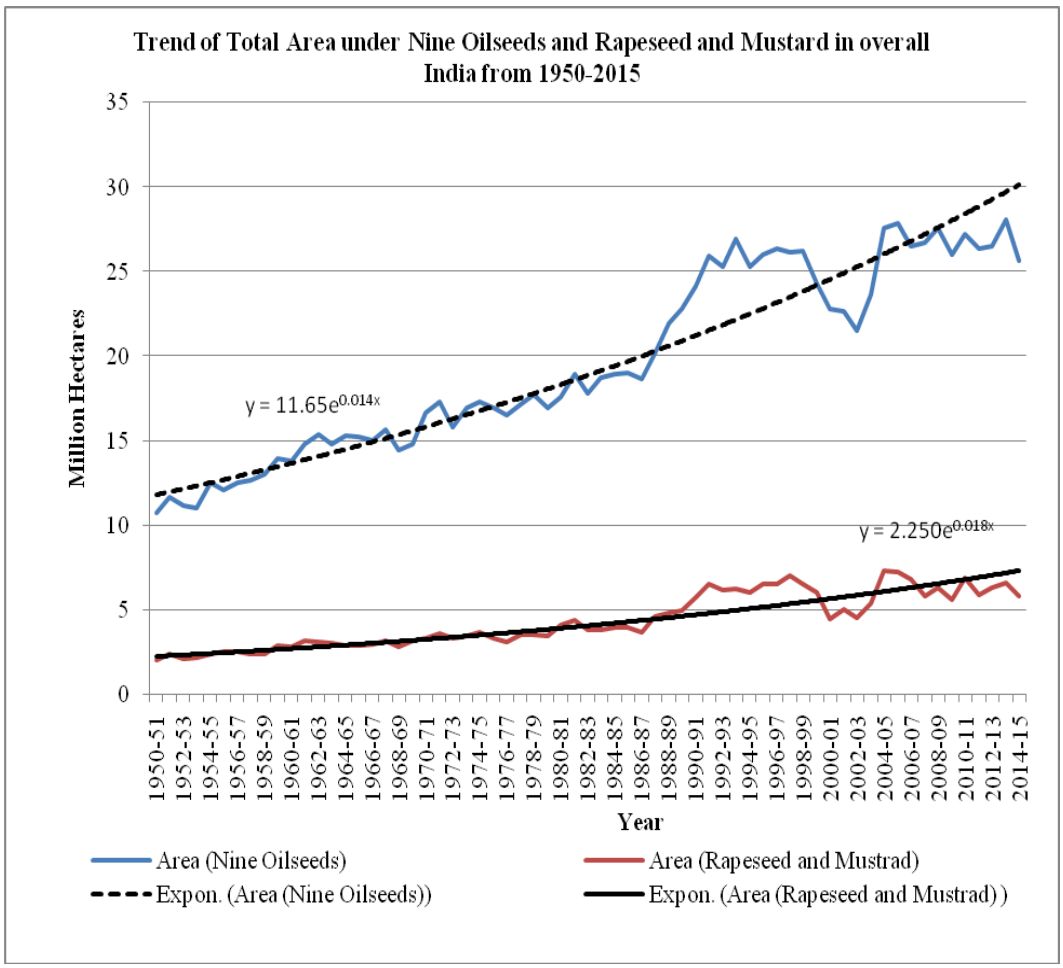


Figure-I

Table-1 Descriptive Statistics of Area, Production and Yield for Oilseed to the different Phases of Green Revolution in overall India during 1950 to 2015

| | Descriptive Statistics of Area | | Descriptive Statistics of Production | | Descriptive Statistics of Yield | |
|---|---|---|---|---|---|---|
| | **Pre-Green Revolution** | | | | | |
| Name of Crops and Statistics | Rapeseed and Mustard | Nine Oilseeds | Rapeseed and Mustard | Nine Oilseeds | Rapeseed and Mustard | Nine Oilseeds |
| Mean | **2.62** | **13.02** | **1.05** | **6.42** | **401.60** | **491.60** |
| Maximum | 3.17 | 15.34 | 1.47 | 8.56 | 507.00 | 561.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Minimum | 2.07 | 10.73 | 0.76 | 4.73 | 300.00 | 424.00 |
| Median | 2.54 | 12.66 | 1.04 | 6.40 | 408.00 | 488.00 |
| Standard Deviation | 0.36 | 1.56 | 0.22 | 1.06 | 49.99 | 37.92 |
| Coefficient of Variation | **13.90** | **12.00** | **20.49** | **16.56** | **12.45** | **7.71** |
| Skewness | 0.12 | 0.14 | 0.73 | 0.10 | 0.05 | 0.19 |
| Kurtosis | -1.27 | -1.28 | -0.64 | 1.18 | 1.00 | 0.03 |
| | **First Phase of Green Revolution** | | | | | |
| Mean | **3.49** | **16.81** | **1.86** | **9.24** | **526.65** | **544.90** |
| Maximum | 4.40 | 18.92 | 3.07 | 12.95 | 771.00 | 684.00 |
| Minimum | 2.87 | 14.47 | 1.23 | 6.40 | 396.00 | 419.00 |
| Median | 3.47 | 16.90 | 1.76 | 9.15 | 510.50 | 530.00 |
| Standard Deviation | 0.40 | 1.40 | 0.48 | 2.01 | 92.87 | 79.04 |
| Coefficient of Variation | **11.59** | **8.31** | **26.09** | **21.81** | **17.63** | **14.50** |
| Skewness | 0.48 | -3.69 | 0.88 | -0.60 | 0.90 | -2.03 |
| Kurtosis | -0.11 | -0.69 | 0.42 | -0.18 | 1.18 | -0.13 |
| | **Second Phase of Green Revolution** | | | | | |
| Mean | **5.86** | **24.84** | **5.73** | **22.49** | **966.82** | **892.95** |
| Maximum | 7.32 | 28.05 | 8.18 | 32.75 | 1234.00 | 1193.00 |
| Minimum | 3.72 | 18.63 | 2.60 | 10.83 | 667.61 | 570.00 |
| Median | 6.02 | 25.92 | 5.81 | 21.81 | 959.30 | 869.00 |
| Standard Deviation | 0.96 | 2.60 | 1.55 | 5.94 | 162.92 | 171.38 |
| Coefficient of Variation | **16.39** | **10.45** | **27.02** | **26.42** | **16.85** | **19.19** |
| Skewness | -0.59 | -1.02 | -0.26 | -0.16 | -0.19 | 0.07 |
| Kurtosis | -0.42 | 0.20 | -0.57 | -0.50 | -0.89 | -0.69 |

Again, from the table-1 it is noticed that the variation or instability of area, production and productivity of Nine Oilseeds and also Rapeseed &Mustard have gone up during the second phase of Green Revolution. The intuitive logic behind these scenario are poor quality of seeds, adverse effect of environment, lack of private and government investment, little success of management technique, deficiency of minor irrigation facilities, moral hazards problem in case of proper utilisation of agricultural credit, etc. It is to be easily understood at a glance with help of the figure-I, figure-II and figure-III respectively. From these figures, it is noticed that an upward trend of area, production and yield during 1950 to 2015, but least fluctuation of all variables up to 1984-85 latter inconsistencies had increased. Besides, the steepness of increasing trend of all selected parameters has been grown up rapidly after 1984-85 that is in the regime of second green revolution or the phases of Technology Mission on Oilseeds (TMO).

From the empirical results of table-2, it is observed that the extensive programme of the government for the development of agricultural has succeeded in the pre Green Revolution or first phase of development in the agricultural sector. The growth rate of area (2.078%) is the highest both for Nine Oilseeds and also Rapeseed & Mustard in the first phase of Green Revolution compared to other regimes of Green Revolution and its level of significance is very high (at 1% level of significance). Again in respect of table-3, it is noticed that though the growth rate of production is lowest both Nine Oilseeds and Rapeseed & Mustard in pre Green Revolution period its level of significance is also the highest (1% level significance). Therefore, it is to be stated that the purpose of extensive programme of the government is (en-courageous) succeed in this situation.

Table-2 Growth Pattern of Area under Nine Oilseeds and Rapeseed and Mustard into different Phases of Green Revolution during 1950-2015 in overall India (Area: Million Hectares)

| Method: Least Squares; Sample:1950-2015; Included Observation:65 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Depended Variable ln(AREA) | Explanatory Variable | Coefficient | Standard Error | Growth Rate (%) | t-Statistics | $R^2$ $\left(\overline{R^2}\right)$ | F-Statistics |
| Nine Oilseeds | Pre-Green Revolution | 0.021 | 0.003 | 2.078 | 6.057* | 0.937 | 301.294* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | First Phase of Green Revolution | -0.005 | 0.005 | 1.600 | -1.001 | (0.934) | |
| | Second Phase of Green Revolution | -0.004 | 0.003 | 1.187 | -1.499** | | |
| | Intercept | 2.381 | 0.037 | | 63.921* | | |
| Rapeseed and Mustard | Pre-Green Revolution | 0.020 | 0.006 | 2.026 | 3.419* | 0.885 | 156.172* |
| | First Phase of Green Revolution | 0.001 | 0.008 | 2.171 | 0.175 | 0.879 | |
| | Second Phase of Green Revolution | -0.007 | 0.005 | 1.482 | -1.440# | | |
| | Intercept | 0.771 | 0.064 | | 11.981* | | |

* Stands for significant at 1% level of Significance, ** Stands for significance at 13% level of significance, #Stands for significant at 15% level of Significant

Again the outcomes of empirical estimation have envisaged that though the intensive programme of Green Revolution and the Technology Mission on Oilseeds are fruitful to increase the growth rate of both production and yield of Nine Oilseeds only the growth rate of yield is significant (at 10% level of significance). So it may remark that the production has increased because of area increase. This scenario is observed from table-3 and table-4. Now, with refer to table-3 and table-4, the growth rate of both production and yield have been gone up significantly for Rapeseed & Mustard during the first phase of Green Revolution almost more than two times. Therefore, in this respect it says that the impact of intensive programme of Green revolution or seed-water-fertilisers technology or HYV technology is encouraging and significant. On the other hand in the second phase of Green Revolution or in the regime of Technology Mission on Oilseeds (TMO), both the growth rate of production and productivity of Rapeseed & Mustard

have been diminished moderately. It is insignificant. These changes can be easily understood from the figure-II and figure-III.

Table-3 Growth Pattern of Production in case of Nine Oilseeds and Rapeseed and Mustard into different Phases of Green Revolution during 1950-2015 in overall India (Production: Million Tonnes)

| Method: Least Squares; Sample:1950-2015; Included Observation:65 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Depended Variable ln(Production) | Explanatory Variable | Coefficient | Standard Error | Growth Rate (%) | t-Statistics | $R^2$ $\left(\overline{R^2}\right)$ | F-Statistics |
| Nine Oilseeds | Pre-Green Revolution | 0.021 | 0.007 | 2.089 | 3.147* | 0.942 | |
| | First Phase of Green Revolution | 0.009 | 0.009 | 3.019 | 1.000 | 0.940 | 332.810* |
| | Second Phase of Green Revolution | 0.003 | 0.005 | 3.302 | 0.520 | | |
| | Intercept | 1.644 | 0.072 | | 22.806* | | |
| | | | | | | | |
| Rapeseed and Mustard | Pre-Green Revolution | 0.025 | 0.009 | 2.558 | 2.815* | 0.936 | |
| | First Phase of Green Revolution | 0.021 | 0.012 | 4.746 | 1.704**** | 0.933 | 299.797* |
| | Second Phase of Green Revolution | -0.011 | 0.007 | 3.598 | -1.533** | | |
| | Intercept | -0.193 | 0.098 | | -1.957*** | | |

* Stands for significant at 1% level of Significance, ** Stands for significance at 13% level of significance, *** Stands for Significant at 5% level of Significance, **** Stands for Significant at 10% level of Significance, #Stands for significant at 15% level of Significant

Tabel-4 Growth Pattern of Yield in case of Nine Oilseeds and Rapeseed and Mustard into different Phases of Green Revolution during 1950-2015 in overall India (Yield: Kg/Hectare)

| Method: Least Squares; Sample:1950-2015; Included Observation:65 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Depended Variable ln(Yield) | Explanatory Variable | Coefficient | Standard Error | Growth Rate (%) | t-Statistics | $R^2$ $\left(\overline{R^2}\right)$ | F-Statistics |
| Nine Oilseeds | Pre-Green Revolution | 0.000 | 0.004 | 0.008 | 0.018 | | |
| | First Phase of Green Revolution | 0.014 | 0.006 | 1.400 | 2.322^ | 0.912 | 210.370* |
| | Second Phase of Green Revolution | 0.007 | 0.003 | 2.090 | 1.965*** | 0.908 | |
| | Intercept | 6.171 | 0.047 | | 130.475* | | |
| | | | | | | | |
| Rapeseed and Mustard | Pre-Green Revolution | 0.005 | 0.006 | 0.497 | 0.864 | 0.910 | |
| | First Phase of Green Revolution | 0.020 | 0.008 | 2.527 | 2.524* | 0.906 | 206.801* |
| | Second Phase of Green Revolution | -0.004 | 0.005 | 2.085 | -0.939 | | |
| | Intercept | 5.947 | 0.063 | | 94.471* | | |

* Stands for significant at 1% level of Significance, ** Stands for significance at 13% level of significance, *** Stands for Significant at 5% level of Significance, **** Stands for Significant at 10% level of Significance, #Stands for significant at 15% level of Significant, ^ Stands for Significant at 2% level of Significance

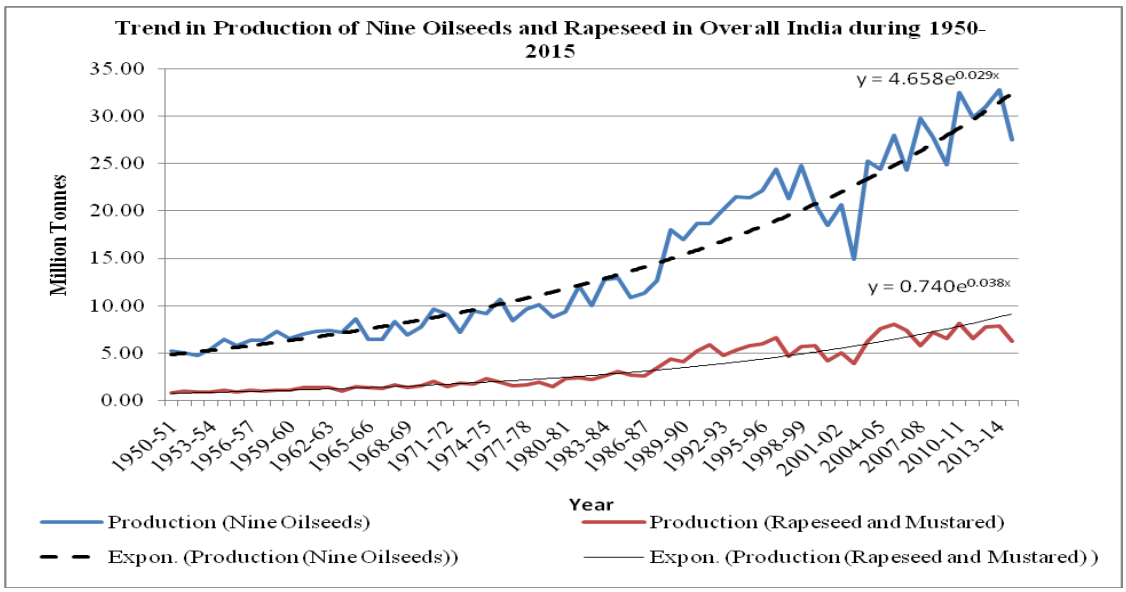


Figure-II

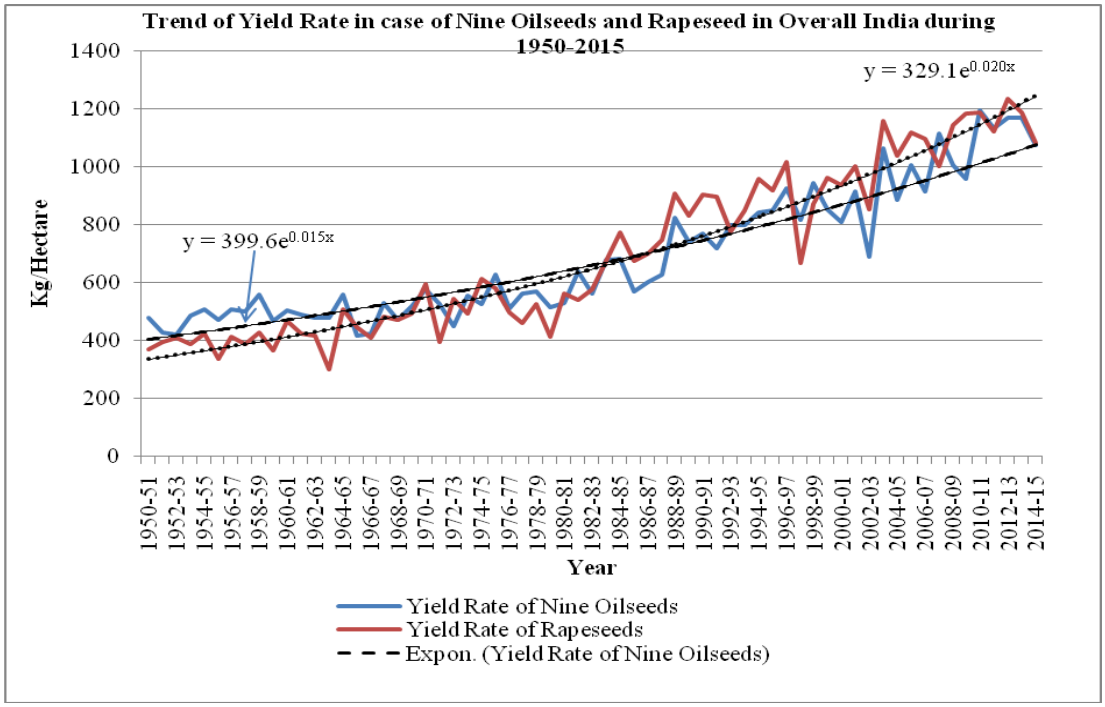


Figure-III

## 5. Conclusion

In this research article it is realised that after independence the various steps such as extensive programme, intensive strategy, Technology Mission on Oilseeds and National Agricultural policy-2000 were taken by the government time to time in different economic plan for achieving

self sufficiency in foods within the shortest possible time. For achieving this target the government implemented. At a glance, all the steps of the government have been classified into three broad categories, such as pre Green Revolution regime (1950 to 1965), first phase of Green Revolution (1965 to 1985) and second phase of Green Revolution (1985-2015).

The 'Spline function' approach has been taken into consideration to analyse what type of changes occurre in the different phases of agricultural development on area, production and productivity of Oilseeds. From the estimated results, it has been observed that the average area, production and yield of Rapeseed & Mustard and Nine Oilseeds have increased in the second phase of Green Revolution satisfactorily but the fluctuation or instability of all parameters (area, production and productivity) have been sustained during the same regime.

Again, it is noticed that the extensive programme for agricultural development has stimulated to increase the area under cultivation of Oilseeds significantly in the pre Green Revolution. The growth rate of both the production and productivity also has been gone up for Nine Oilseeds but for Rapeseed and Mustard the growth rate of same parameters has been come down. So it is concluded that the Technology Mission on Oilseeds (TMO) or second regime of Green Revolution is substantial succeeded to change in area, production and yield rate of Oilseeds. Therefore, from above analysis it is also remarked that the overall impact of Green Revolution is favourable for rapid agricultural development and become self-sufficiency in agricultural production.

References:

[1] Bardhan, P., "Green Revolution and Agricultural Labours" EPW, Vol.5, pp.1239-1249, July 1970.

[2] Brahmanand et al., "Agronomic strategies for forever green revolution", *Yojana*, p. 21, March 2000.

[3] Byers, T.J., "The dialectics of Indian green revolution", *South Asian Review*, Vol. 5, No. 32, 1972.

[3] Castillo, G.T. et al., "*The Green Revolution at the Village Level: A Philippines Case Study* (1963-1970)", University of the Philippines, College of Agriculture Farm and Home Development, Laguna, 1971.

[4] Datt, G. and Sundharam's, K.P.M India Economy, S. Chand & Company Pvt. Ltd, 2015.

[5] Gujrati, D. N. and Sangeetha, Basic Econometrics (Fourth Edition), Tata McGraw Hill Education Private Limited, 2009.

[6] Gupta,K.R. and Gupta, J.R., Indian Economy Vol.I, Atlantic Publishers & Distributers (P) Ltd, 2008.

[7] http://www.gktoday.in/isopom

[8] Hashmi, S.N., "Impact of new agricultural technology on the agricultural development in Haryana", *The Geographer,* Vol. 41, No. 2, July 1994.

[9] Hegde, Dr. N.G. (www.baif.org.in), "Second Green Revolution for Sustainable Livelihood Security of Small Farmers"; BAIF Development Research Foundation, Pune 411 058.

[10] Husain, M., "*Green Revolution in India - A Systematic Agricultural Geography",* New Delhi, pp. 357-417, 2002.

[11] Maheshwari, A., "Green revolution, market access of small farmers and stagnation of cereals yield in Karnataka", *Indian Journal of Agricultural Economics*, Vol. 53, No. 1,. pp. 27-39, January – March 1998.

[12] Poirier, G.D.: The Econometrics of Structural Change, North-Holland, Amsterdam, Chapter 2, 1974.

[13] Sen, B., "Opportunities in the green revolution", *Economic and Political Weekly*, pp. A33-A38, March 1970.

[14] Sen, B., "*The Green Revolution in India – A Perspective"*, New Delhi, 1974.

[15] Sharma, V.P., "Problem and prospects of Oilseeds Production in India (Final Report)", Centre For Management in Agriculture (CMA), IIM, Ahmedabad, November 2014.

[16] Shive, V., "The violence of the green revolution, *Research Foundation for Science and Ecology"*, Dehradun, 1989.

[17] Sondhi, R. and Singh, K., "Impact of high-yielding varieties on agricultural wages in Punjab", *Indian,Journal of Agricultural Science*, Vol. 44, No. 1, pp. 1-7, January 1974.

[18] Subramanian, C., "*The New Strategy in Indian Agriculture"*, New Delhi, 1979.