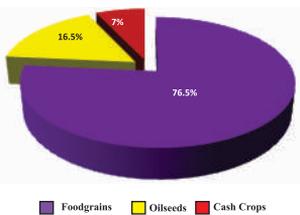
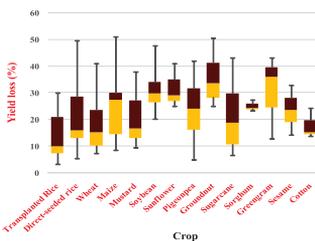


Yield and Economic Losses Due to Weeds in India

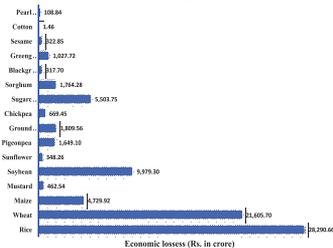
Economic losses due to weeds in major crops



Actual yield loss (%) due to weeds



Economic losses due to weeds



Yogita Gharde and P K Singh



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ICAR - Directorate of Weed Research, Jabalpur (Madhya Pradesh)

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India Map



Technical Bulletin No. 17

Yield and Economic Losses Due to Weeds in India

Yogita Gharde and P K Singh



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Foreword

Weeds are considered an important biotic constraint to food production. Their competition with crops reduces agricultural output in terms of quantity as well as quality, and increase cost of cultivation involved in the control of weeds. It is also a major constraint to increase agricultural productivity and farmers' income, particularly in developing countries like India. Therefore, taking into consideration the importance of weed management, the Indian Council of Agricultural Research decided to establish the National Research Centre for Weed Science, which came into existence on 22nd April, 1989. This centre was further upgraded as Directorate of Weed Science Research on 23 January, 2009; and renamed as ICAR- Directorate of Weed Research on 26 November, 2014. This is a unique institute in the National Agricultural Research System which has entered the Limca Book of Records for being the only one of its own kind in the whole world dealing exclusively with weed research.

Since inception, the Directorate has played a pioneering role in conducting weed survey and surveillance, development of weed management technologies for diversified cropping systems, herbicide resistance in weeds, biology and management of problem weeds in cropped and non-cropped areas, environmental impact of herbicides and utilization of weeds. Adoption of these advanced weed management technologies has been promoted on large areas through on-farm research and demonstrations, which has raised agricultural productivity and livelihood security of the farmers.

Similarly, the launching of the All India Coordinated Research Project (AICRP) on Weed Control in 1978, which renamed as, AICRP on Weed Management since 2014, was an important step forward by the Indian Council of Agricultural Research to develop and test location specific weed management technologies and carry out demonstrations on farmers' field. Presently, 17 centres of AICRP-Weed Management are running in all the major State Agricultural Universities throughout the country.

In the present bulletin, an assessment was made on yield losses due to weeds in major field crops in different states of India where centres of AICRP-WM were present. This was done using the data from farmers' fields, reported by 18

centres during 2003-2014. Monetary losses occurred due to weeds in different states were also reported in the bulletin. It is hoped that this document will be beneficial to policy makers and all other stakeholders including scientists, field functionaries and farmers for having idea about the yield as well as economic losses due to weeds in major field crops in different states of India. I am highly grateful to Dr. T. Mohapatra, Director General, ICAR and Secretary, DARE and Dr. K. Alagusundaram, Deputy Director General (NRM) for their keen interest and providing needed support and visionary thoughts for carrying out such activities of the Directorate. I also thank Dr. S. Bhaskar, Assistant Director General (Agronomy, Agro-forestry and Climate Change) and Dr. S.K. Chaudhari, Assistant Director General (Soil and Water Management) for their guidance and support. Thanks are due to various individuals including Dr. Shobha Sondhia, Incharge, AICRP-WM and all PIs/scientists of various centres of AICRP-WM for providing support to bring out this publication. The efforts made by authors for bringing out this document are acknowledged.

Date : 01 Sept. 2018

Place : Jabalpur



(P.K. Singh)

Director

Content

S.No.	Topic	Page No.
1.	Introduction	1
2.	Methodology	5
	2.1 Field trials	5
	2.2 Calculation of Yield Losses due to Weeds	6
	2.3 Calculation of Economic Loss	6
3.	Results	7
	3.1 State wise yield losses due to weeds	7
	3.1.1 Bihar	7
	3.1.2 Chhattisgarh	7
	3.1.3 Gujarat	7
	3.1.4 Haryana	8
	3.1.5 Himachal Pradesh	8
	3.1.6 Jharkhand	9
	3.1.7 Karnataka	9
	3.1.8 Kerala	10
	3.1.9 Madhya Pradesh	10
	3.1.10 Maharashtra	11
	3.1.11 Odisha	12
	3.1.12 Punjab	12
	3.1.13 Rajasthan	13
	3.1.14 Tamil Nadu	13
	3.1.15 Telangana	14
	3.1.16 Uttar Pradesh	14
	3.1.17 Utrkhand	15
	3.1.18 West Bengal	16
	3.2 Estimates of average yield losses due to weeds	17
	3.3 Potential yield losses due to weeds	18
	3.4 Actual yield losses due to weeds	19
	3.5 Economic losses due to weeds	20
	Annexure-I	
	Annexure-II	

Yield and Economic Losses Due to Weeds in India

1. Introduction

Sustainable crop production is one of the major challenges in today's agriculture where resources are limiting but demands for foodgrains increasing. Both biotic and abiotic stresses are found almost equally responsible for losses in agricultural production. As with abiotic causes, particularly the lack or surplus of water in the growing season, high temperatures, high or low irradiance and nutrient supply; biotic stresses also have the potential to reduce yields substantially (Oerke, 2006). Weeds are considered as the most harmful biotic constraints to agricultural production besides affecting agro-biodiversity and natural water bodies. These are the major agricultural pests that can destroy a crop if not properly managed. In addition to direct effect on crop yield, weeds result in substantial reduction in the efficiency of inputs supplied. The precious and costly inputs such as fertilizers and irrigation water which are otherwise meant for realizing the potential yield will be grabbed by the weeds. In general, impact of weeds on crop yields varies from high input to low input crop production systems.

Weed causes harm to crops in many ways and this happens due to the unusual adaptation characteristics of the weeds and their regeneration ability. Therefore, weed management is the major and important part of crop production. Furthermore, prevention is the most essential aspect of weed management. Once a harmful weed infestation becomes established, any increase in size and density creates more expensive management efforts. But, despite the development and adoption of various weed management technologies, the problem of weeds is increasing day by day due to the way we manage our crop lands and other non-cropped situations. Further, In India, increasing globalization and unchecked import of seed materials and food grains from other countries in the past have led to invasion of alien weeds in the country. In view of this, yield loss caused due to weeds has become the major burning issue for discussion in the present scenario.

In general, the yield loss due to weeds is almost always caused by a group of different weed species, and these species can differ considerably in competitive ability (Weaver and Ivany 1998). Basically, it is very difficult to estimate the yield loss due to single weed species and therefore, it is estimated as the cumulative loss by all the weeds. It was proved that weeds are economically more important than insects, fungi or other pest organisms (Savary *et al.* 1997, 2000). Globally, weeds caused the highest potential loss (34%), with animal pests and pathogens being less important (losses of 18 and 16% respectively). It has been estimated that on an average, weeds caused 5%

loss in agricultural production in most developed countries, while loss is 10% in developing countries and 25% in least developing countries (Oerke, 2006).

Globally, many studies have been conducted in past on yield losses in different crops. In one of the studies, Milberg and Hallgren (2004) assessed the relative importance of differences between regions, crops, soils, and years using data from herbicides testing field trials to explore large-scale patterns in yield loss in cereals due to weeds in Sweden. They compared yield of herbicide treated plot with yield of unweeded control plots. Moreover, O'Donovan *et al.* (2005) developed various regression equations based on weed density alone, or relative time of weed and crop emergence or crop density in addition to weed density in western Canada to estimate the effects of weeds on yield loss of field crops, and also to advise farmers regarding economics of weed control with herbicides. They emphasized on the implementation of the weed economic threshold concept which is likely to be more feasible in low-value crops such as feed barley than in higher-value crops such as canola. Furthermore, Oerke *et al.* (2006) presented an overview on different types of crop losses as well as on various methods of pest control developed in past. Estimates on potential and actual losses despite the current crop protection practices for wheat, rice, maize, potato, soybean, and cotton for the period 2001-03 on a regional basis (19 regions) were also presented. As far as economic loss is concerned, several studies have been conducted to assess the economic losses due to weeds in a particular region. Swanton *et al.* (1993) presented average annual monetary losses due to weeds in province of Canada (Table 1).

Table 1. Estimated average annual losses due to weeds in province of Canada.

Province	Average annual monetary losses
\$ X 1000	
Eastern Canada	
New foundland	446
Prince Edward Island	21413
Nova Scotia	7795
New Brunswick	18040
Quebec	165012
Ontario	159530
Western Canada	
Manitoba	130318
Saskatchewan	286957
Alberta	155103
British Columbia	39781

Table 2. Estimated average annual losses due to weeds by commodity group in Eastern and Western Canada.

Region	Average annual monetary losses
\$ X 1000	
Eastern Canada	
Hay (tame)	186040
Field crops	123919
Fruits and vegetables	62277
Eastern Canada total	372236
Western Canada	
Hay (tame)	70967
Field crops	515908
Fruits and vegetables	20717
Fruit trees	4567
Western Canada total	612159
Canada Total	984395

In India, Bhan *et al.* (1999) estimated and suggested that weeds in India reduce crop yields by 31.5% (22.7% in winter and 36.5% in summer and *Kharif* seasons). In other studies, weeds were reported to cause up to one-third of the total losses in yield, besides deteriorating quality of produce and causing health and environmental hazards (DWSR, 2013). Indian Weed scientists of India estimated losses due to weeds from 10% to 100% (Table 3). It was reported that even a conservative estimate of about 10% loss (Bhan *et al.*, 1999) would amount to a loss of food grains valued at approximately US\$ 13 billion (Yaduraju, 2012). However, the total economic losses will be much higher, if indirect effects of weeds on health, losses of biodiversity, nutrient depletion, grain quality, etc. are taken into consideration.

Table 3. Potential yield loss due to weeds in different major crops of India [Rao *et al.* 2014].

Crop	Yield losses (%)	Crop	Yield losses (%)
Chickpea	10-50	Pea	10-50
Cotton	40-60	Pearlmillet	16-65
Fingermillet	50	Pigeonpea	20-30
Greengram	10-45	Potato	20-30
Groundnut	30-80	Rice	10-100
Horsegram	30	Sorghum	45-69
Jute	30-70	Soybean	10-100
Lentil	30-35	Sugarcane	25-50
Maize	30-40	Vegetables	30-40
Niger	20-30	Wheat	10-60

In such studies, yield loss estimation from experimental situation is conditional on local effects and sometimes it is valid only for some specific cropping situation where it may be difficult to extrapolate the results for producers' yield losses. The reason may be the experimental conditions that might not be the representative for a field situation (Walker, 1987, Savary *et al.*, 1998). Further, it is more acceptable to establish results from field trials comparing the different treatments in the farmers' field (Walker, 1983, Zanin *et al.*, 1992, Oerke *et al.*, 1994, Oerke and Dehne, 1997, Tamado *et al.*, 2002). Hence, to observe the extent and variability of yield losses due to pests, data from farmers' field are needed (Friesen and Shebeski, 1960, Taylor and Lill, 1986). Therefore, keeping this in view, the present study was undertaken to reassess the yield losses (potential and actual) estimates along with economic losses due to weeds in major field crops grown in different states of India based on data from farmers' fields of the respective state.

2. Methodology

2.1 Field trials

A study was conducted at ICAR-Directorate of Weed Research, Jabalpur to estimate the yield losses as well as economic losses due to weeds using the data from a total of 1821 On-Farm Research trials conducted by different centres of All India Coordinated Research Project on Weed Management (AICRP-WM) in 16 major crops in different districts of 18 states of India. These trials were conducted during 2003-04 to

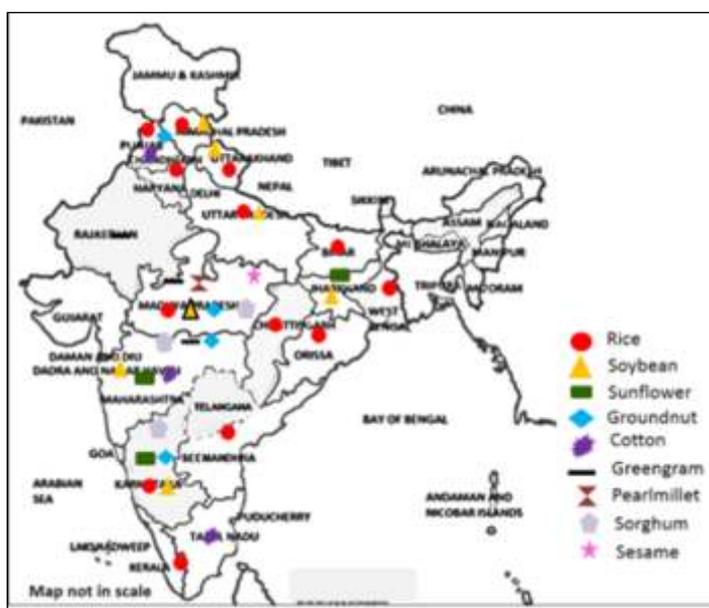


Fig 1 (a). Map of India depicting the states whose data was considered for calculation of yield and economic losses due to weeds for different crops given as legends

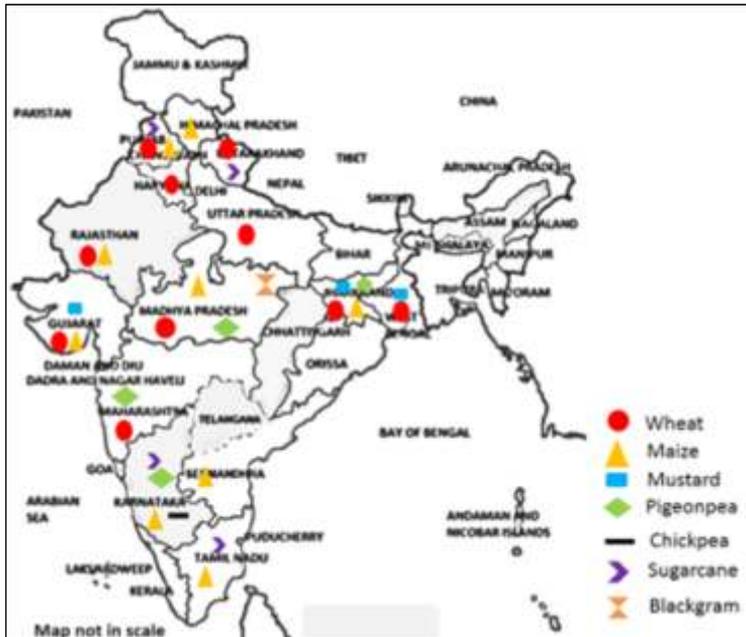


Fig 1 (b). Map of India depicting the states whose data was considered for calculation of yield and economic losses due to weeds for different crops given as legends

2014-15 in different states where the centres of AICRP-WM are located (Fig 1 a & b). These centres were located in Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand and West Bengal. Data on yield losses in three treatments viz. farmers' practice, weedy check and weed free (2 Hand Weeding) were used for the study. Weedy check (unweeded control) treatment includes no control of weeds. Similarly, farmers' practice includes the conventional weed management methods adopted by farmers. Yield data of farmers' practice was used to estimate actual yield losses in different crops whereas; yield data of weedy check plot was used to estimate the potential yield loss *vis a vis* weed free situation.

2.2 Calculation of Yield Losses due to Weeds

In each state (where AICRP-WM centres located), major crops were selected for calculation of yield losses, however only one or two crops were chosen in some states depending upon the availability and suitability of the data for consideration. Average yield loss data were obtained for major crops of each state and subsequently this data was used to calculate economic losses due to weeds in each state. Yield data on farmers' practice, weedy check and weed free were used for the study. Following formulas were used for calculation of yield losses:

$$\text{Actual yield loss due to weeds} = \left(\frac{WF_y - FP_y}{WF_y} \right) \times 100 \quad \dots\dots\dots (1)$$

$$\text{Potential yield loss due to weeds} = \left(\frac{WF_y - WC_y}{WF_y} \right) \times 100 \quad \dots\dots\dots (2)$$

where, WF_y - crop yield in weed free situation, FP_y - crop yield in farmers' practice, and WC_y - crop yield in weedy check plot.

2.3 Calculation of Economic Loss

In order to calculate the economic losses due to weeds, normal estimates of the production of different crops (average of 2008-09 to 2013-14) in different states and Minimum Support Price (MSP) of the crops (except fair and remunerative price for sugarcane) for the crop year 2014-15 were considered. Estimates of economic losses were obtained for each state using the following formula:

$$\text{Economic loss due to weeds} = \text{Normal estimate of production} \times \left(\frac{\% \text{ yield loss due to weeds}}{100} \right) \times \text{MSP} \quad \dots\dots\dots (3)$$

3. Results

3.1 State wise Yield losses due to weeds

Results on state wise yield losses in major crops as well as economic losses are presented in the following sections.

3.1.1 Bihar

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Transplanted rice	10.0	-
2.	Maize	-	65.0
3.	Wheat	-	16.5

Few data were available for AICRP-WM centre in Bihar. Therefore, economic loss due to weeds was calculated only for transplanted rice and it came out as ₹ 732 crore due to 10% actual yield losses in farmers' field by using the formula given in equation 3.

3.1.2 Chhattisgarh

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Rice	25.6	65.9

In Chhattisgarh, rice is the main and only crop which is grown virtually in entire area of the state. In farmers' field, actual yield loss due to weeds is 25.6% whereas potential yield loss is as high as 65.9%. Thus, actual monetary loss due to weeds is ₹ 4142 crore in farmers' field in the state.

3.1.3 Gujarat

S.No.	Crop	Actual yield loss (%)
1.	Maize	8.6
2.	Wheat	9.3
3.	Mustard	9.6

Data was collected for major crops namely maize, wheat and mustard and subsequently yield data was used to compute the yield loss due to weeds. Actual yield losses were very low in case of all three crops. Hence, economic losses due to weeds is calculated as ₹ 659 crore in farmers' field.

3.1.4 Haryana

S.No.	Crop	Actual yield loss (%)
1.	Wheat	9.5
2.	Rice	7.9

In Haryana, yield losses were very low in wheat and rice crops *i.e.* 9.5 and 7.9% respectively. Data on potential yield loss was not available for computation. Thus, actual economic loss is calculated as ₹ 1995 crore in farmers' field.

3.1.5 Himachal Pradesh

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Rice	29.3	43.3
2.	Maize	12.7	-
3.	Soybean	37.5	-

In Himachal Pradesh, yield data was available for rice, maize and soybean crops. Therefore, actual yield loss is calculated as 29.3% in rice, 12.7% in maize and 37.5% in soybean. Potential yield loss due to weeds in rice crop is reported as 43.3% in rice, however, this was not available for maize and soybean crops. Thus, actual economic loss in farmers' field is calculated as ₹ 157 crore in the state.

3.1.6 Jharkhand

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Rice-upland	49.7	66.2
2.	Pigeonpea	42.0	-
3.	Sunflower	41.0	-
4.	Linseed	33.0	-
5.	Mustard	38.0	-
6.	Soybean	30.0	-
7.	Maize	51.0	-
8.	Wheat	43.0	-

Yield data were collected for 8 crops in Jharkhand viz. rice, pigeonpea, sunflower, linseed, mustard, soybean, maize and wheat. Actual yield loss data was reported in all these crops ranging from 30-51%. Potential yield loss was recorded as high as 66.2% in rice whereas, its actual yield loss data is 49.7%. Actual yield loss is reported high in case of maize as 51% as compared to other crops. Thus, total actual economic loss is calculated as ` 2344 crore in farmers' field due to weeds in these crops except linseed for which MSP was not available.

3.1.7 Karnataka

S.No.	Crop	Actual yield loss (%)
1.	Maize	21.5
2.	Rice	32.5
3.	Sorghum	23.5
4.	Groundnut	29.4
5.	Chickpea	35.0
6.	Pigeonpea	28.3
7.	Soybean	25.5
8.	Sunflower	29.1
9.	Sugarcane	25.5

Centre located at Karnataka reported yield loss data in major field crops such as maize, rice, sorghum, groundnut, chickpea, pigeonpea, soybean, sunflower and sugarcane. Actual yield loss reported in this state varies between 21.5 - 35%. Moreover, highest actual yield loss was reported in chickpea (35%) and lowest in maize (21.5%) and thus total monetary losses occurred due to weeds was calculated as ` 7471 crore in all these crops.

3.1.8 Kerala

S.No.	Crop	Actual yield loss (%)
1.	Dry-seeded rice	14.3

Rice is the major field crop for Kerala and thus actual yield loss was calculated as 14.3% in dry-seeded rice in the state. Subsequently, economic loss was computed as ₹ 105 crore in the state due to weeds.

3.1.9 Madhya Pradesh

Centre located in Madhya Pradesh reported yield loss in major field crops namely soybean, blackgram, greengram, groundnut, sesame etc. Actual and potential yield losses due to weeds in these crops are given below:

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Soybean	47.7	61.1
2.	Blackgram	30.7	50.9
3.	Greengram	36.2	56.5
4.	Groundnut	50.7	70.7
5.	Sesame	32.9	58.0
6.	Maize	30.2	54.2
7.	Sorghum	27.4	49.5
8.	Wheat	16.3	39.1
9.	Pearlmillet	27.6	41.1
10.	Pigeonpea	5.1	-
11.	Transplanted rice	30.0	-

In the state, actual yield loss is reported as low as 5.1% in pigeonpea and as high as (50.7%) in case of groundnut. Most of the crops experienced comparatively more yield loss even in farmers' field. Actual yield loss in most of the crops lies between 30-50%. Therefore, they also contributed more in the total economic losses in farmers' field which is calculated as ₹ 13375 crore due to weeds.

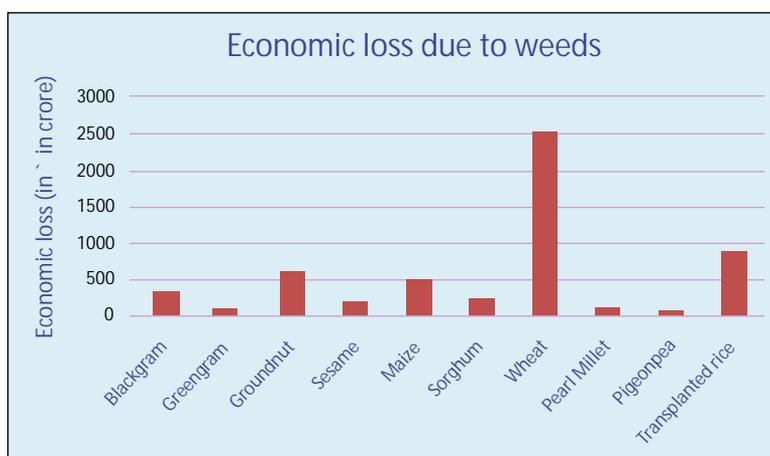


Fig 2. Economic losses due to weeds in important crops of Madhya Pradesh

3.1.10 Maharashtra

Data on yield losses due to weeds were calculated based on the data reported by centre located in Maharashtra for major field crops namely groundnut, sorghum, soybean, cotton, pigeonpea, greengram etc.

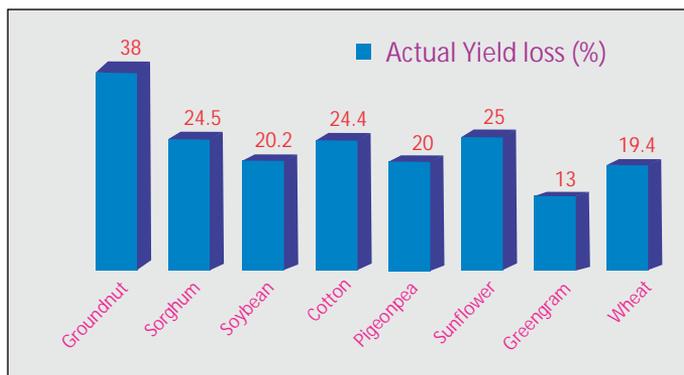


Fig 3. Actual yield losses due to weeds in important crops of Maharashtra

Centre reported higher yield loss in farmers' field due to weeds as compared to other states. It varies between 13-38% in different crops. Highest actual yield loss was observed in groundnut (38%) whereas lowest was recorded in greengram (13%). Economic loss due to weeds was calculated based on the actual yield loss data and the MSP of the crops and was obtained as ₹ 5149 crores.

3.1.11 Odisha

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Direct-seeded rice	16.8	58.7
2.	Transplanted rice	3.4	15.0

Rice is the main crop of Odisha and grown in virtually almost entire area of the state and therefore yield loss data was calculated for rice crop. Farmers experienced 16.8% actual yield loss in direct-seeded condition, whereas, it is only 3.4% in transplanted condition. Thus, altogether economic loss due to weeds was calculated as ₹ 2558 crore in rice.

3.1.12 Punjab

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Maize	14.5	-
2.	Wheat	7.5	20.0
3.	Rice	5.6	-
4.	Sugarcane	6.6	-
5.	Cotton	13.9	-
6.	Groundnut	25.0	-

Punjab, the Food Basket of India, is an agrarian state. Agriculture has an important role in the culture and economy of the state. Most of the development in agriculture started from Punjab and therefore, plays important role in Indian agriculture. Centre in Punjab recorded yield loss in major field crops of the state viz. maize, wheat, rice, sugarcane, cotton and groundnut. Actual yield loss is observed between 5.6 - 25%. Highest actual yield loss was experienced by groundnut (25%) crop and lowest (5.6%) by rice crop. Thus, based on the actual yield loss data, economic loss due to weeds was calculated and subsequently it was obtained as ` 2822 crore.

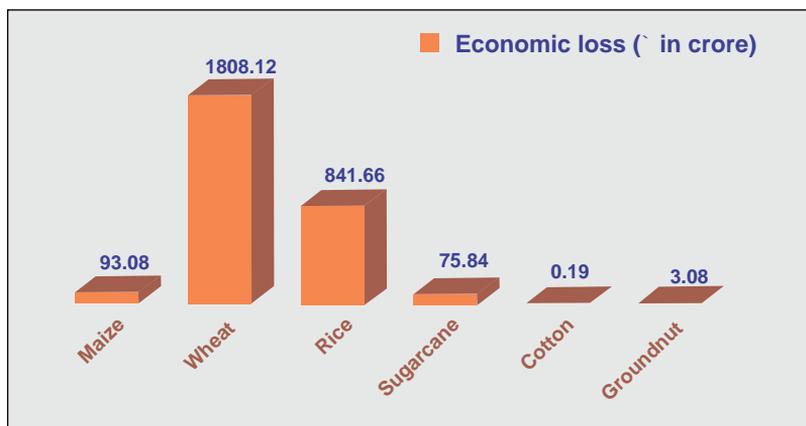


Fig 4. Economic losses due to weeds in important crops of Punjab

3.1.13 Rajasthan

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Wheat	28.8	31.5
2.	Greengram	43.3	-
3.	Maize	33.0	-

AICRP centre located at Rajasthan reported yield loss due to weeds in three major field crops namely wheat, greengram and maize. Table shows that actual yield loss is 28.8% in wheat and 33% in maize but it is very high in case of greengram (43.3%). Subsequently, economic loss due to weeds was calculated and finally it was obtained as ` 5009 crore in all three crops.

3.1.14 TamilNadu

Yield loss data was observed on cotton, maize and sugarcane only. Actual yield loss data reported by the centre is 15.3% in cotton, 28.7% in maize and 43.2% in sugarcane. Thus, altogether economic loss due to weeds was calculated as ` 3713 crores in three crops.

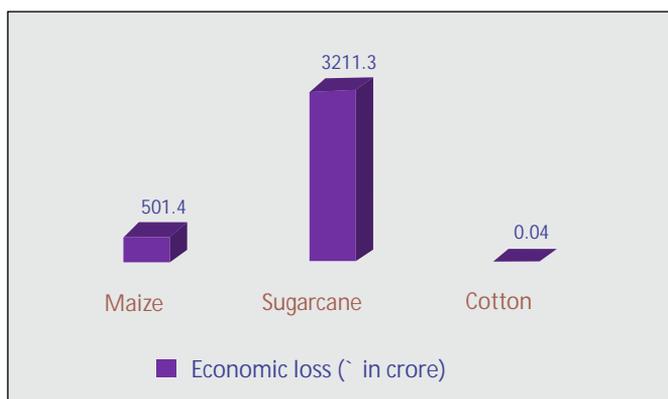


Fig 5. Economic losses due to weeds in important crops of Tamil Nadu

3.1.15 Telangana

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Rice	11.4	32.3
2.	Maize	17.6	27.6

In Telangana, yield loss data was available only for two major field crops of the state viz. rice and maize. Calculation showed that potential yield loss is high in rice (32.3%) as compared to maize which it is 27.6%. Simultaneously, actual yield loss is low (11.4%) in rice as compared to maize (17.6%). Thus total economic loss in Telangana state for two major crops namely rice and maize is ₹ 3378 crore.

3.1.16 Uttar Pradesh

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Rice	26.5	46.8
2.	Wheat	25.0	33.5
3.	Maize	-	36.7
4.	Pigeonpea	-	33.6
5.	Groundnut	-	45.0
6.	Sorghum	-	35.0
7.	Soybean	-	50.0

Data on weedy check treatment plots were reported by centre in seven major crops namely rice, wheat, maize, pigeonpea, groundnut, sorghum and soybean. It was very high in case of soybean (50%) followed by rice (46.8%). Potential yield loss was ranging between 33.5 - 50% in different major crops. However, yield data on farmers' field was reported only for rice and wheat. Therefore, economic losses due to weeds was calculated as ₹ 15463 crore in these two crops.

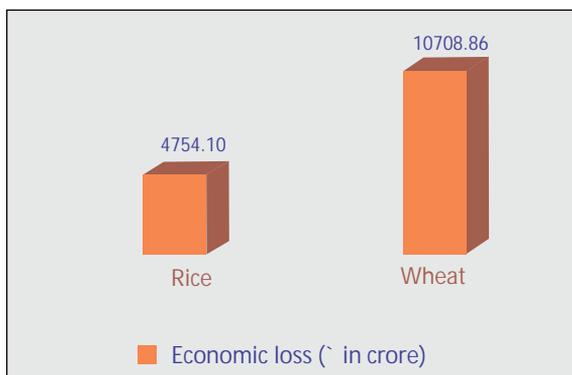


Fig 6. Economic losses due to weeds in important crops of Uttar Pradesh

3.1.17 Uttrakhand

S.No.	Crop	Actual yield loss (%)	Potential yield loss (%)
1.	Soybean	29.6	76.4
2.	Rice	15.2	54.8
3.	Wheat	14.5	41.4
4.	Sugarcane	12.2	67.8

Centre reported data on yield in different treatments in different crops namely soybean, rice, wheat and sugarcane. This data was used to calculate the actual and potential yield losses due to weeds. Results showed that potential yield loss was very high in case of soybean (76.4%) followed by sugarcane (67.8%) whereas, actual yield loss was low in case of sugarcane (12.2%) which showed that the effective weed control measures are being used by the farmers of the state in the crop. Economic loss due to weeds was computed based on actual yield losses and overall it was obtained as ₹ 542 crore.

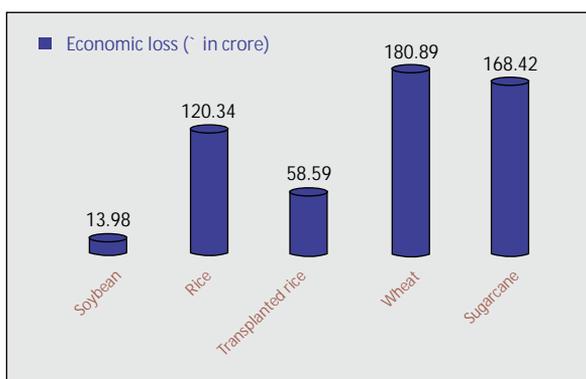


Fig 7. Economic losses due to weeds in important crops of Uttrakhand

3.1.18 West Bengal

S.No.	Crop	Actual yield loss (%)
1.	Rice	15.0
2.	Mustard	16.7
3.	Wheat	12.9
4.	Sesame	14.4

Centre reported yield loss in four crops namely rice, mustard, wheat and sesame. Actual yield loss data was ranging from 11.2 - 16.7% in different crops. Lowest actual yield loss was reported in rice followed by wheat. Reason could be the use of effective weed control measures in controlling weeds in these crops. Subsequently, economic loss due to weeds was calculated and obtained as ₹ 8976 crore in all reported crops.

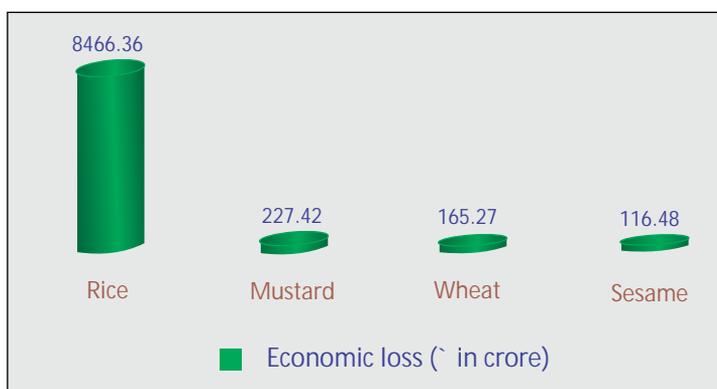


Fig 8. Economic losses due to weeds in important crops of West Bengal

Based on the data on yield losses of all states, combined analysis was also performed and information was generated representing the country level figures on yield losses due to weeds. Therefore, country level estimates on yield losses are given in following sections.

3.2 Estimates of average yield losses due to weeds

Potential and actual yield losses are presented in Table 4 which shows the average yield losses due to weeds. Though, average is not a good measure to present the data having great variation among the states but it was further used to calculate the economic losses due to weeds. Instead, a good picture of the yield losses can be presented with the help of box plot diagram which are shown in Fig. 9, 10 and 11.

Table 4. Potential and actual yield losses (%) due to weeds in major field crops

Crop	Potential yield loss (%)	Actual yield loss (%)
Transplanted rice	48.2*	13.8
Direct-seeded rice		21.4
Wheat	30.3	18.6
Maize	43.4	25.3
Mustard	-	21.4
Soybean	62.5	31.4
Sunflower	-	31.7
Pigeonpea	33.6	23.9
Groundnut	57.9	35.8
Chickpea	-	35.0
Sugarcane	67.8	21.9
Sorghum	42.3	25.1
Blackgram	50.9	30.7
Greengram	56.5	30.8
Sesame	58.0	23.7
Cotton	-	17.9
Pearlmillet	41.1	27.6

* Potential yield loss (%) in rice

3.3 Potential yield losses due to weeds

Using the yield data from weedy check *vis a vis* weed free situation, potential yield losses due to weeds were calculated and presented through box plot diagram (suitable data was available only for 6 major crops). It depicted that potential yield loss is very high in case of soybean *i.e.* 50-76% followed by groundnut where it is 45-71%. More variability in the yield losses was observed among the different states in case of crops such as transplanted rice (15-66%) and maize (18-65%).

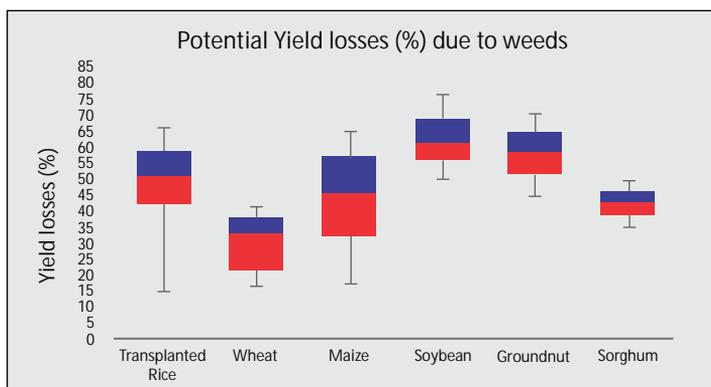


Fig 9. Potential yield losses due to weeds in major field crops of India

Box plot depicts the 'Minimum value', 1st Quartile 'Q1', 'Median', 3rd Quartile 'Q3' and 'Maximum value' of the yield loss data (bottom to up). End point of the minus error bar is the minimum value, red area shows the difference between median and Q1, blue area shows the difference between Q3 and Median and upper most point of the plus error bar is maximum value of the data.

In past studies, very high potential yield losses due to weeds were presented; sometimes even upto 95-97% (Rao *et al.* 2014). This may be due to biasedness in planned experiments where weedy check treatment plot is considered fixed for 3-4 years of experimentation and due to the favourable conditions for growth and development in this treatment plot, weed seed bank get increased over years. Sometimes, it may also depend on the soil composition of the region. If more numbers of weed seeds are present in the soil, then it is expected to have more weeds in the growing season of the associated crops. However, data reported from different centres do not support such high values of potential yield losses due to weeds alone in any crops. The reason could be the site of data collection *i.e.* farmers' field in different geographical region.

3.4 Actual yield losses due to weeds

It is clear from Table 4 that average actual yield loss (%) is more in case of major pulses and oilseeds crops as compared to major cereal crops. For eg. soybean, sunflower, groundnut, chickpea, blackgram, greengram etc. experienced more yield losses as compared to wheat and rice. Further, it was observed that depending upon the growth condition of crops and intensity of weeds, actual yield losses varies greatly among different states (Fig 10). This variation was high in case of maize (7-51%) followed by direct-seeded rice (6-49%), pigeonpea (5-42%) and sugarcane (7-43%). Yield losses due to weeds are less in transplanted rice as compared to direct-seeded rice this may be due to the control of initial flush of weeds by puddling and flooding in transplanted condition. Besides this, it is generally observed to have more weed competition in case of direct-seeded rice as compared to transplanted rice.

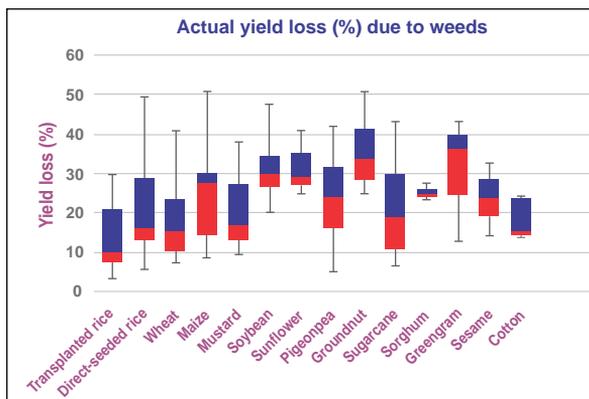


Fig 10. Actual yield losses due to weeds in major crops of India

3.5 Economic losses due to weeds

As far as economic loss is concerned, actual economic losses is highest as 36% (₹ 28290.67 crore) of total loss in case of rice (total) followed by wheat (₹ 21605.72 crore) and soybean (₹ 9979.30 crore) (Fig 11). Rice experienced only 14% actual average yield loss in transplanted and 21% in direct seeded condition but due to high production it is considered as the most economically affected crop than others. Further, potential yield loss upto 66% was observed in case of rice where weeds were not controlled and left to grow with crops. It indicates that many weed management methods are being used at farmer's level to control weeds in rice and in wheat as well. Fig 12 shows that foodgrains (cereals, pulses and millets) experienced more economic losses due to weeds (76.5%) followed by oilseed crops (16.5%) and cash crops viz. sugarcane and cotton (7%). All together total actual economic loss in these major crops in 18 states are estimated as ₹ 78591 crores due to weeds alone.

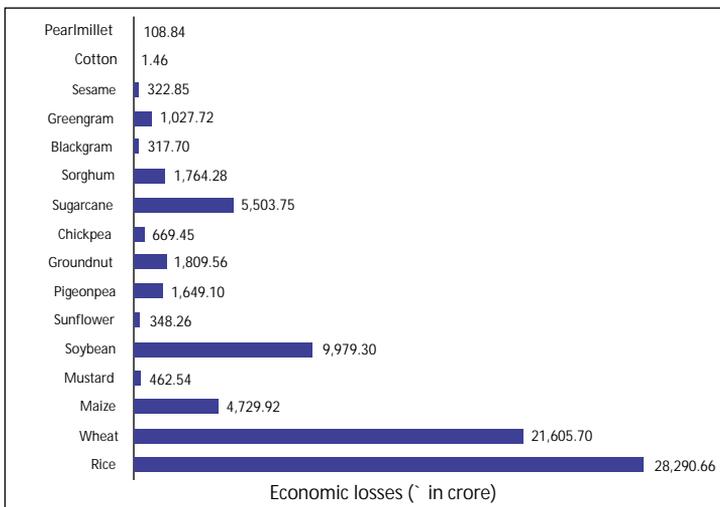


Fig 11. Economic losses (₹ in crore) due to weeds

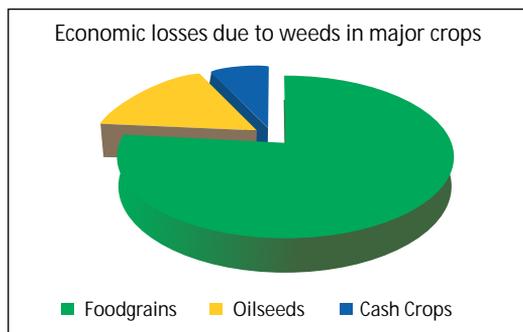


Fig 12. Economic losses due to weeds in important crops

Economic losses due to weeds are very important statistics for policy makers and others, including researchers to understand the impact of weeds as far as economic loss is concerned. Further, it has been learnt that still it can be considered as underestimation of economic losses because data did not include those states where yield data was not available for a particular crop. It may be much greater than what is actually estimated from the data.

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Average production ('000 tonnes) of 16 crops in different states of India

S. No.	State	Crop	Average Production ('000 tonnes)
1.	Bihar	Rice	5379.8
		Maize	1823.4
		Wheat	4697.7
2.	Chhattisgarh	Rice	5924.6
3.	Gujarat	Maize	534.8
		Wheat	3616.3
		Mustard	372.8
4.	Haryana	Wheat	11546.5
		Rice	3766.0
5.	Himachal Pradesh	Rice	122.5
		Maize	647.8
		Soybean	0.81
6.	Jharkhand	Rice	2350.9
		Pigeonpea	127.0
		Sunflower	0.6
		Linseed	12.1
		Mustard	105.4
		Soybean	0.33
		Maize	348.5
		Wheat	264.8
7.	Karnataka	Maize	3800.3
		Rice	3754.1
		Sorghum	1334.2
		Groundnut	539.8
		Chickpea	602.4
		Pigeonpea	423.8
		Soybean	169.8
		Sunflower	254.2
		Sugarcane	36509
		Wheat	222.4
8.	Kerala	Rice	541.5
9.	Madhya Pradesh	Soybean	6479.8
		Blackgram	237.9
		Greengram	50.0
		Groundnut	300.0
		Sesame	136.4
		Maize	1286.3
		Sorghum	548.7

		Wheat	10729
		Pearlmillet	315.5
		Pigeonpea	297.9
		Rice	2175.9
10.	Maharashtra	Groundnut	369.6
		Sorghum	2782.6
		Soybean	3981.5
		Cotton	1.29
		Pigeonpea	953.2
		Sunflower	74.6
		Greengram	239.4
		Wheat	1627.4
11.	Odisha	Rice	6892
12.	Punjab	Maize	490.0
		Wheat	16626
		Rice	11051
		Sugarcane	5223.4
		Cotton	0.35
		Groundnut	3.08
13.	Rajasthan	Wheat	8394.7
		Greengram	402.3
		Maize	1624.6
14.	Tamil Nadu	Maize	1333.7
		Sugarcane	33789
		Cotton	0.069
15.	Telangana	Rice	12417
		Maize	4018.6
16.	Uttar Pradesh	Rice	13175
		Wheat	29601
		Maize	1200.3
		Pigeonpea	288.2
		Groundnut	83.4
		Sorghum	202.0
		Soybean	15.6
17.	Uttrakhand	Soybean	18.67
		Rice	582.15
		Wheat	860.34
		Sugarcane	6275.04
18.	West Bengal	Rice	14477.4
		Mustard	439.28
		Wheat	883.55
		Sesame	175.85

Average data of years from 2008-09 to 2013-14

Minimum support price of 16 field crops during 2014-15 in India

S.No.	Crop	MSP (₹/q)
1.	Rice	1360
2.	Maize	1310
3.	Wheat	1450
4.	Soybean	2350
5.	Sunflower	3750
6.	Groundnut	4000
7.	Sugarcane	220
8.	Blackgram	4350
9.	Greengram	4600
10.	Sesame	4600
11.	Pearlmillet	1250
12.	Sorghum	1540
13.	Mustard	3100
14.	Cotton	3900
15.	Pigeonpea	4350
16.	Chickpea	3175

PUBLISHED NEWS



Economic Loss Due to Weeds A pan India investigation

Weeds are a threat to agricultural productivity. Though there are studies that estimate yield and economic loss due to weeds in particular localities or crops, they tend to focus on short-term effects. Such studies may not reveal the magnitude of the problem.



Source: S. Suresh Ramanan

Now, scientists from the ICAR-Directorate of Weed Research and the Krishi Vigyan Kendra, in Jabalpur, compiled data from 1581 field trials to provide a more holistic picture. The data were collected from the trials conducted by centres of the All India Coordinated Research Project on Weed Management 2003 to 2014. The study covered 18 Indian states. The scientists focused on ten major field crops: transplanted rice, direct-seeded rice, soybean, groundnut, sorghum, pearl millet, green gram, sesame, wheat, maize and mustard.

Two types of treatments were applied in all the field trials. One was a completely weed-free condition achieved by combining mechanical weeding and herbicide application. The other adopted either mechanical

weeding or herbicide application or no weeding at all, as per the practice of local farmers. The scientists also maintained control plots where no mechanical or chemical weeding was done. Thus, they could collect data related to potential loss (weed free plots vs control plots) as well as actual loss (weed free vs farmers' practice of weed removal). Among the ten crops evaluated, we found that both potential as well as actual yield loss are more in groundnut and soybean," says Yogita Gharde, ICAR Directorate of Weed Research.

The team collected field data to determine the most critical factors contributing to yield loss. They found that crop, soil type and location significantly influenced yield loss due to weeds.

They used the minimum support price from 2014–2015 to compute economic loss based on yield at the different treatment trials. And they found that economic losses at an All India level can go as high as Rs 29,446 crores for rice and Rs 22,490 crores for wheat.

The magnitude of loss in agricultural productivity due to weeds is a wake-up call to policy makers. Now, it is up to agricultural scientists to devise methods to control weeds using ecologically sustainable approaches.

Crop Protect., 107: 12–18

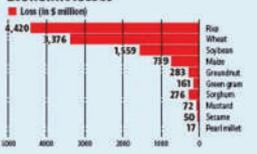


SENSEX FALLS FOR THE FIFTH STRAIGHT SESSION ON WEAK GLOBAL CUES

CROPS LOST TO WEEDS

\$11 billion worth of crop losses are caused annually by weeds in India, says a study published in the journal Crop Protection

Economic losses



Anona Dutt
www.outlookindia.com

NEW DELHI: Weeds lead to India losing an average of \$1.1 billion each year in major crops, shows data from 1,581 farm trials in 18 states. "Weeds are notorious yield reducers that are, in many situations, economically more harmful than insects, fungi or other crop pests," said a study, published in the journal, Crop Protection. Insects, diseases and weeds are the three main biological factors for losing crop yield and causing economic loss to farmers. Unlike the visible impact of diseases and insects, the impact of weeds goes unnoticed," said Dr Yogita Gharde, lead author of the paper and scientist at the Directorate of weed research at Indian Council of Agricultural Research.

"If weed growth is not stopped at sowing time, it results in massive crop loss, sometimes as high as 70%," said Gharde. The study reviewed three types of fields - where weeds were left uncontrolled, where weeds were controlled using local practices, and fields where weeds were controlled completely. "We calculated the yield loss and then used the government's minimum selling price to calculate the economic loss to the farmers."

Yield losses (%) due to weeds



SEASON RAINNY
Transplanted rice
Soybean
Groundnut
Sorghum
Pearl millet
Green gram
Sesame
SEASON WINTER
Wheat
Maize
Mustard

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1805

Page: 1 (01) of 40

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WEED MENACE

Crops lost

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[Source: Anona Dutt, HT]

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India loses farm produce worth \$11b to weeds every year: ICAR - Business Line

India loses farm produce worth \$11b to weeds every year: ICAR

TV JYOTI Updated on January 15, 2018

f t in +

in \$ million

Rice	4,420
Wheat	3,376
Soybean	1,559
Maize	739
Groundnut	283
Sorghum	276
Green gram	161
Mustard	72
Sesame	50



Losses suffered by rice, wheat top list

NEW DELHI, JANUARY 15

India loses agricultural produce worth over \$11 billion — more than the Centre's budgetary allocation for agriculture in 2017-18 — annually to weeds, according to a study by researchers associated with the Indian Council of Agricultural Research (ICAR). As per ICAR data, the annual economic losses due to weeds were found to be highest in rice, followed by wheat (\$2,276 billion) and soybean (\$1.5 billion). However, the average yield loss in the lowest is rice — 14 per cent in transplanted rice and 21 per cent in direct seeded condition.

Production factor

The overall loss was up because of high rice production in India, and the study, which appeared online in the journal *Crop Protection*, on Friday.

The greatest average loss, in the other hand, was reported from groundnut cultivation, followed by maize and soybean. A groundnut farmer on an average lost 34 per cent of his crop to weeds, resulting in an estimated loss of \$47 per hectare.

The average losses in maize and soybean farming were \$236 and \$171.8, respectively. The average yield loss in wheat was \$16 per ha.

The researchers, from the Jabalpur-based Directorate of Weed Research (DWR), estimated the economic losses using data generated by an all India co-ordinated research project on weed management, which carried out 1,581 on-farm research trials in 18 states over a different duration in 1950s till now.

"We analysed the research by statistically analysing the data from this project in which 25 ICAR institutes were participating," said R.P. Chhabra, an agronomist with DWR and a co-author of the study.

http://www.bhaskar.com/article/INDIA-LOSES-FARM-PRODUCE-WORTH-11-BILLION-EVERY-YEAR-DUE-TO-WEEDS-11632990.html



भा कृ अनु प - खरपतवार अनुसंधान निदेशालय

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जबलपुर, मध्य प्रदेश

Jabalpur, Madhya Pradesh

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