



## **Assessment of Fertilizer Applicator while Spraying Fertilizers in Warangal and Nagarkurnool District, India**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author AJ designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AJ and RA managed the analyses of the study. Author AJ managed the literature searches. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

Indian population is 73% depended on agricultural activities for their livelihood. Increasing population has increased the intensity of agricultural production for feeding and doubling of food production has increased usage of fertilizers. Spraying of fertilizers has reported to be a drudgery process by farmers. In the present study the fertilizer applicator developed by a farmer in Wyr, Khammam district was studied in comparison to traditional practices of fertilization broadcasting and pocketing. The applicator studied in the present study is farmer friendly technology. Low cost Rs 2500 equipment which can be used with one labor and cattle pair. The results of the study concluded that with usage of fertilizer applicator the drudgery is reduced to 3 on REBA Scale which is low risk. It is cost effective and time saving technology compared to traditional fertilization methods of broadcasting fertilizers and pocketing fertilizers.

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**Keywords:** Fertilizers; fertilization; broadcasting; pocketing; fertilizer applicator.

## 1. INTRODUCTION

India is an agricultural based country and 73% of population is directly or indirectly depends upon the farming. Increasing population has increased the intensity of agricultural production for feeding [1,2]. The doubling of agricultural food production worldwide up to the 1990s can be partly attributed to an increase usage of fertilizers [3,4]. The WHO (World Health Organization) estimates there are more than 1 million pesticide cases in every year. Farmers apply fertilizers to their cropland excessively and indiscriminately because of a lack of training in continuous innovations in developing countries [5]. Over-fertilization is a one of the contributors to groundwater and atmospheric pollution as a result of leaching, gentrification apart from adversely affecting productivity and fruit or crop quality [6]. The traditional practice of spraying fertilizers is manually by using hands for which more efforts are required and consumers more time, fertilizers and injurious to health. Multi-crops fertilizer spraying equipment's for is not available [7].

There are many technologies to spray fertilizers like Backpack (Knapsack) Sprayer, Lite-Trac: Motorcycle Driven Multi-Purpose Farming Device (Bullet Santi), Aerial Sprayer [8]. Fertilizer broadcasting a traditional method in which fertilizers are cast across the surface of crop fields by hand, a method that cannot control the rate of nutrient frequency, triggers inefficient fertilization. It is reported to increases production costs by roughly 33% and greenhouse gases by 60% and also decreases yields by roughly 15–18% [9]. In this method fertilizers are lost due to rain, irrigation, or sublimation by sun radiation [10]. For steep slopes where terracing is not practiced, forking in of fertilizers or pocketing them into the soil is recommended by Yew, [11]. According to the reports of IFDC, 2013 till 2012 only 2.5 million farmers used deep placement and the rest practice the broadcasting. Broadcasting is costly and labor-intensive and not affordable to farmers. The unscientific usage of fertilizers causes environmental risks.

## 2. METHODOLOGY

### **Objective:**

1. Usage of fertilizer applicator reduces drudgery while spraying pesticides

2. Usage of fertilizer applicator reduces time required for spraying fertilizers (Less time more area spread)
3. Usage of fertilizer applicator reduces labor charges.

**Problem:** Farmers face drudgery while application of fertilizer and its laborious, time consuming and costly.

**Study Area:** Two districts of Telangana state of India were studied in the present study. They are Warangal district from central Telangana zone and Nagarkurnool district of southern Telangana zone.

**Study Subject:** The farmers involved in cultivating Castor, Cotton, Redgram and Chillies withcattle pairspraying fertilizer in their fields were selected.

**Sample Size and Sampling Technique:** Sample size is sixty farmers and farm women n=60. Thirty from each district Nagarkurnool n=30 and Warangal n=30. Purposive sampling techniques were done to select farmers having bullock carts.

**Data Collection:** The study was carried out during 2018-2020 three years in two districts of rural Telangana state-Warangal District of central Telangana zone and Nagarkurnool district of southern Telangana Zone. The preliminary data of family background, agricultural lands, crop production usage of fertilizers, time consumed, labor hired etc were collected before the study through questionnaire method. The survey method is used to monitor the spraying of fertilizers, time consumed. Drudgery was calculated on REBA scale.

**Intervention:** Training program, Method demonstrations and awareness programs were part of interventions.

**Data Analysis:** Drudgery was calculated on REBA scale [12].

REBA stands for Rapid Entire Body Assessment and was developed by Hignett and McAtamney [12]. As a means to assess entire body posture for risk of WRMSDs. REBA has been developed to fill a perceived need for a practitioner's field tool, specifically designed to be sensitive to the type of unpredictable working postures found in health care and other service industries.

**Table 1. REBA score**

Score	Risk level
1	Negligible Risk/No Risk
2-3	Low Risk
4-7	Medium Risk
8-10	High Risk
11+	Very high Risk

### 3. RESULTS AND DISCUSSION

The farmers involved in cultivating Castor, cotton, Redgram and Chillies with cattle pairspraying fertilizer in their fields were selected and was conducted in two districts of Telangana state of India. Warangal district from central Telangana zone and Nagarkurnool district of southern Telangana zone was selected. A Sample size of sixty farmers and farm women n=60 were selected, n=30 from each district. Three methods of applying fertilizers were studied Farmers Practice (FP) means broadcasting the fertilizers as shown in Fig. 1, T<sub>1</sub> means pocketing of fertilizers as shown in Fig. 2 and T<sub>2</sub> means using the fertilizer applicator shown in Fig. 3.



**Fig. 1. Broadcasting of fertilizers (FP)**



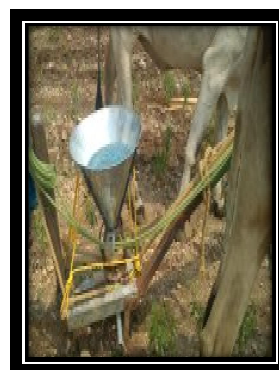
**Fig. 2. Pocketing of fertilizers (T<sub>1</sub>)**



**Fig. 3. Pocketing of fertilizers (T<sub>2</sub>)**

The fertilizer applicator was made up of cone in which fertilizers is poured, it is tied to cattle pair. It has small pipes which were applying fertilizers exactly at place needed (5cms away from plant) on both sides and an adjustable valve to adjust the fertilizer quantity. This was developed by a farmer at Wyra. The innovative idea of farmer which is low cost technology Rs 2500/ applicator was studied for its efficiency.

The drudgery while spraying fertilizers with all the three methods like broadcasting, pocketing and fertilizer applicator were studied in both districts n=60 and the results were calculated by the REBA Scale designed by Hignett and McAtamney [12].



**Fig. 4. Fertilizer applicator**

The results shown that in broadcasting drudgery was 8 on REBA Scale which indicates high risk and while pocketing it was 10 on REBA scale which indicates high risk, whereas the drudgery while spraying fertilizer with fertilizer applicator was less than 3 which indicates low risk.

The usage of fertilizer with broadcasting and pocketing was more compared to fertilizer applicator as shown in Table 3. Time consumed to spray fertilizer per acre of land was recorded

**Table 2. Showing the results of technical observations FP, T<sub>1</sub> and T<sub>2</sub>**

Descriptions of activities		Technical observations	
Fertilizer application method	Farmers practice Broadcasting (FP)	Pocketing (T <sub>1</sub> )	Fertilizer applicator (T <sub>2</sub> )
Amount of Fertilizer	Fertilizer consumption more	Fertilizer consumption more	Less compared to FP and T <sub>1</sub>
Area coverage / 8hrs	Time consumption 1 acre/8h	Time consumption 1 acre/8h	Time consumption 3.5 – 4 acres/8h
Man/day	Persons required: 1 persons	Persons required: 3 persons	1 person
Stress	Strain : More	Strain : More	less
REBA scale	Drudgery on REBA scale 8 scale	Drudgery on REBA scale 10 scale	Drudgery on REBA scale< 3 scale

**Table 3. Usage of fertilizer per acre of land while spraying fertilizer by FP, T<sub>1</sub> and T<sub>2</sub>**

Crop	Farmers practice Broadcasting (FP)	Pocketing (T <sub>1</sub> )	Fertilizer applicator (T <sub>2</sub> )
Cotton	Urea: 150 KG	Urea: 100 KG	Urea: 85 KG
	DAP: 75KG	DAP: 50KG	DAP: 45KG
	MOP:130 KG	MOP:100 KG	MOP:90 KG
Redgram	Urea: 150 KG	Urea: 100 KG	Urea: 85 KG
	DAP: 75KG	DAP: 50KG	DAP: 45KG
Chilli	Urea: 200 KG	Urea: 150 KG	Urea: 150 KG
	DAP: 75KG	DAP: 50KG	DAP: 45KG
	MOP:80 KG	MOP:50 KG	MOP:45 KG
Castor	Urea: 130 KG	Urea: 100 KG	Urea: 50 KG
	DAP: 100KG	DAP: 75KG	DAP: 65KG
	MOP:70 KG	MOP:50 KG	MOP:40 KG

Note\* the information of table III has been gathered through questionnaire method calculated by average of n=60

**Table 4. Average labor charges in Warangal and Nagarkurnool district**

Labour charges Rs 200/8 hour	Farmers practice Broadcasting (FP)	Pocketing (T <sub>1</sub> )	Fertilizer applicator (T <sub>2</sub> )
n=1	n=1	n=3	n=1
Rs 200/8 hour/ acre	Rs 200/8 hour/ acre	Rs 600/8 hour/ acre	Rs 200/8 hour/ 3.5-4 acre

using timer, it was found that in 8 hour one acre land was spread and pocketed with fertilizers where as 3.5-4 Acres of land was sprayed fertilizers using fertilizer applicator. Hence more area was covered in less time. The efficiency of fertilizer applicator is more compare to other two methods as shown in Table 2.

The labor charges for broadcasting were calculated per acre, it requires one person per one acre where as in pocketing it requires three persons per acre. With fertilizer applicator it requires one person and cattle pair. The average labor charges in Warangal and Nagarkurnool district explained in Table 4.

Table 4 explains that one labor cost is Rs 200/8 hours. In broadcasting one labor is required but area covered per 8 hour is only one acre where

as pocketing requires three labor for eight hours to complete fertilization of one acre of land. In case of fertilizer applicator with one labor and cattle pair in same time (8 hours) 3.5-4 acre of land is fertilize. Hence it's proved that fertilizer applicator is cost effective and time saving apart from reducing drudgery.

#### 4. CONCLUSION

In the present study the fertilizer applicator developed by a farmer in wyra, Khammam district was studied. It's a farmer friendly technology. Low cost Rs 2500/- equipment which can be used with one labor and cattle pair. The study concluded that with usage of fertilizer applicator the drudgery is reduced to 3 on REBA Scale which is low risk compared to broadcasting drudgery which was 8 on REBA Scale indicates

high risk and pocketing it was 10 on REBA scale which indicates high risk. The results also indicates that fertilizer applicator technology used in present study is cost effective and time saving compared to traditional fertilization methods of broadcasting fertilizers and pocketing fertilizers.

## 5. RECOMMENDATIONS

- ❖ Fertilizers were applied exactly at place needed (5 cms away from plant)
- ❖ Time saving
- ❖ Easy to use and handle- farmer friendly technology.
- ❖ Lesser chances of inhalation and health hazards
- ❖ Lesser physical strain
- ❖ Increases the productivity of work
- ❖ Reduces lower back pain
- ❖ Farmers owning cattle pair will be benefited with this technology as its cost saving where as farmers who don't own cattle pair must rent on extra charges which will be more. Hence this technology is effective for farmers owning cattle pair.

## DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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