The Journal of Rural and Agricultural Research Vol. 20 No. 2, 37-40 (2020)
Received November 2020; Acceptance December 2020

Comparative economics of neem coated urea vis-a-vis ordinary urea in wheat

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Abstract

To come up with a comparative economics picture of Neem Coated Urea and Ordinary Urea, field experiments were conducted during rabi *season of 2017-18 and 2018-19 at Agronomy Research Area of CCS Haryana Agricultural University, Hisar. The objective of the experiment was to study the effect of different nitrogen levels and sources on economics of wheat. The experiment was laid out in a split plot design with four nitrogen sources [Ordinary Urea (½ Basal and ½ at first irrigation), Ordinary Urea (½ Basal + ¼ first irrigation + ¼ heading), Neem Coated Urea (½ Basal + ½ first irrigation) and Neem Coated Urea (½ Basal + ¼ first irrigation + ¼ heading)] in main plots and four nitrogen levels (80%, 90%, 100% RDN and 110% RDN) in sub plots replicated thrice. The experimental site is situated in the sub tropical region at 29° 10′ N latitude and 75° 46′ E longitude with an elevation of 215.2 meter above mean sea level in Haryana State of India.Overall results depicted that application of neem coated urea produced better wheat profitability. Neem coating in urea found to be cost-effective as compared to uncoated ordinary urea due to its slow releasing property and higher nutrient use efficiency. Wheat plants can absorb nitrogen present in urea fully without any loss and thereby, check its higher doses leading to saving of hard-earned money of the farmers. Among different nitrogen sources, highest gross returns, net return and B:C were recorded with 3 split application of neem coated urea which were higher than ordinary urea (2 and 3 split).The gross returns, net returns and B:C increased with increase in nitrogen levels up to 100 % RDN. Highest gross returns, net return and B: C was recorded with 110 % RDN in both the year of experimentation.*

Key words: Wheat, neem, coated urea, fertilizer, economics, nitrogen

Introduction

Wheat (*Triticum aestivum* L.) is the second most important cereal crop of India and plays a vital role in food and nutritional security of the country. Nearly 55 per cent of the world population depends on wheat for about 20 per cent of calories intake. It is one of the major food grains of the country and a staple food of the people of North India, where people have preference for chapatti. Wheat is the second most important cereal crop of India and plays a vital role in food and nutritional security of the country. Nearly 55 per cent of the world population depends on wheat for about 20 per cent of calories intake. It is one of the major food grains of the country and a staple food of the people of North India, where people have preference for chapatti.

Chemical fertilizers assume a greater significance in terms of ensuring a sufficient food-grain production in the country. In fact, it is important to note that this role has witnessed a comprehensive transformation of the traditional cultivation practice to modernization of agriculture. As the expansion of area under cultivation is not possible, arable land is declining (Venugopal, 2004), while soil is becoming increasingly deficient in many plant nutrients due to the intensive nature of agricultural production. Further, improper use of nutrients has led to multi-nutrient deficiency in the soils and the resultant soil quality deterioration and stagnant yield of crops. Fertility status of any area is mainly determined by three primary nutrients namely, Nitrogen, Phosphorus and Potassium of which nitrogen plays a very crucial role. Urea is the fertilizer which is major supplier of nitrogen, which is necessary for the growth of plants. Because of this reason, urea consumption is very high all over the globe.

Unfortunately only 30-40 per cent of nitrogen present in urea is actually utilized by the plants. Because of its agronomic acceptability and relatively lower cost, urea is the most common nitrogenous fertilizer used extensively across the world. Scientific studies have established that despite being a rich source of nitrogen with associated advantages, urea has the inherent limitations of heavy water solubility and adverse environmental impact. Also, malpractices of diverting the heavily subsidized Urea for other uses in chemical industry and milk adulteration process at times become issues of major concern. As such, efforts are on to improve its NUE which finally have resulted in evolution of slow release neem coated urea standardized by National Fertilizer Limited. Nitrogen present in urea is released in the soil and water and is leached by the activity of Nitrobacteria and Nitrosomonas (Nitrifying bacteria). These nitrifying bacteria convert nitrogen into nitrite and then to nitrate which are highly mobile in nature in soil. In this processes, approximately 50 per cent of the applied nitrogen in urea is lost through leaching into the soil, causing extensive ground water contamination. Coating urea with neem is a solution to the problem as it prevents the bacterial activity of nitrification. Neem is considered to be the best nitrification inhibiting agent till now, even better than sulphur. Recent research indicates that coating neem on urea also discourages an age-old mal-practice of this cheap fertilizer being diverted for use in the chemical industries. As neem coated urea (NCU) releases nitrogen in a slow process, crop plants can absorb it fully without any loss and thereby, check the use of higher doses of urea, leading to saving of hard-earned money of the farmers. The Government has therefore now made it mandatory for urea manufacturers to produce neem coated urea up to a minimum of 75 per cent of their total production of subsidized urea. Besides acting as a natural pesticide, neem coating in urea also helps check the diversion of highly subsidized urea to non-agricultural uses. Further, in order to ensure a balanced use of fertilizers and reduce the consumption of urea, the Government has decided to introduce a 45 kg bag of urea in place of 50 kg bags from 2018 onwards. Although all the steps taken by the government of India till now appear to be well-intended, they have failed to promote a balanced use of fertilizers. Tanwar *et al.* (2014) studied that the nitrogen release pattern under laboratory incubation condition resulted that neem coated urea significantly higher value over others this could be due to slow releasing properties and reduced volatilization loses. It released nitrogen slowly thereby increase availability of ammonical form of nitrogen. Keeping the above aspects in view, the present investigations "Economics of neem coated urea vis-a-vis ordinary urea in wheat" was planned for two consecutive years to verify the economic advantage of using neem coated urea and yield response of wheat to different doses of nitrogenous fertilizer.

Materials and Methods

The field experiments were conducted at Agronomy Research Area of CCS Haryana Agricultural University; Hisar has a semi-arid and sub-tropical climate with hot, dry and desiccating winds during summer and severe cold during winter season. The mean monthly maximum temperature during summer months of May - June is around 42ºC to 45ºC while the minimum temperature during winter months of December and January sometimes goes as low as 0 ºC or less than this. The average annual rainfall of Hisar is about 400 mm which is mainly received during July to September with a few showers of cyclonic rains received during winter months of December and January or early spring.The experiment was laid out in a split plot design with four nitrogen sources [Ordinary Urea (½ Basal and ½ at first irrigation), Ordinary Urea (½ Basal + ¼ first irrigation + ¼ heading), Neem Coated Urea (½ Basal + ½ first irrigation) and Neem Coated Urea (½ Basal + ¼ first irrigation + ¼ heading)] in main plots and four nitrogen levels (80%, 90 %, 100 % RDN and 110 % RDN) in sub plots replicated thrice. Land was prepared by ploughing twice and planking once, followed by pre-sowing irrigation. During both the years a basal dose consisting of 60 kg P_2O_5/ha was applied to all the plots at sowing time as single superphosphate through seed-cum-fertilizer drill .Wheat seed was sown during first fortnight of December and harvested in between 15 and 20 April in both the years. Wheat variety WH 1105 was sown with row-to-row spacing of 20 cm. The other agronomic practices like irrigation, weed control measures and insect-pests control were done as per recommended package of practices of CCSHAU, Hisar. Harvesting and threshing of wheat was done manually so as to minimize yield losses. Five representative plants from each plot were selected and tagged randomly for recording the effect of different treatments on yield attributes of wheat. The cost of

field preparation, sowing of seeds, thinning, weeding, plant protection, harvesting and cleaning contributed to fixed cost. The variable cost included the cost of irrigation charges and labour for application of fertilizer and irrigation. The gross income of crop was worked out from average grain yield produced under different nitrogen sources and nitrogen levels treatments. To find out the net income, the cost of each treatment was subtracted from the total gross income. The expenditure incurred on individual treatments was worked out from the detail assessment of the variable and fixed costs involved such as land preparation, seed, plant protection, chemicals and labour engaged in different field operations. Gross income for all treatment was calculated separately taking into consideration grain and straw yield of individual crop. Thereafter, net returns were calculated after subtracting expenditure incurred on the individual treatment from the gross income of the same treatment.

The benefit: cost ratio of wheat in the present experiment was calculated as follows.

$$\text{B:C ratio} = \frac{\text{Gross return (Rs. ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs. ha}^{-1}\text{)}}$$

Results and discussion

The ultimate goal of any farm owner or grain producer is maximum net return per unit area after deduction of cost of cultivation. The data pertaining to economics of wheat as influenced by varying sources and levels of nitrogen application is presented in Table 1. A critical examination of data in Table 1 revealed that economic parameters of wheat showed significant relation with the different source and levels of nitrogen. Cost of cultivation of wheat was slightly lower in neem coated urea (30,674 Rs ha^{-1}) as compared to ordinary urea (30,688 Rs ha^{-1}). Among various nitrogen sources gross returns was highest with three split application of neem coated urea (½ Basal + ¼ first irrigation + ¼ heading) (1,00,122 Rs ha^{-1} in 2017-18 and 1,05,638 Rs ha^{-1} in 2018-19) in both the year of experimentation. The improvement in gross return of wheat with neem coated urea application in the present experiment might be due to increase in yield attribute and yield of wheat in these treatments. Higher yield of wheat due to application of neem coated urea might be due to better growth parameters with the increasing and steady supply of nitrogen which results in higher number of tillers and number of grains per spike of wheat. Singh *et al.,* (2006) at Ludhiana also studied that the modifications in fertilizer source and/or management can lead to high wheat yields.

Performance of wheat in terms of net returns were also better in three split application of neem coated urea drilled during sowing of wheat than other treatments. The net return of wheat varied from 65,921 to 74,964 Rs ha^{-1} in both the years. The increase in net returns with application of 110 % RDN as compared to 100% RDN was Rs 794 and Rs 1383 in the year 2017-18 and 2018-19 respectively. Neem coating has shown its superiority in enhancing the nitrogen use efficiency, grain yield, nitrogen content in grain of wheat crop in all tested soils (Suganya et al., 2007). The overall picture, based on two years mean values, reflects the fact that highest benefit: cost ratio

Table 1: Economics of wheat as influenced by varying nitrogen sources and levels

Treatments	Cost of cultivation (Rs./ha)		Gross return (Rs./ha)		Net return (Rs./ha)		B:C	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
Nitrogen sources								
Ordinary Urea (2-split)	30,688	30,688	97,247	96,609	65,921	66,559	3.15	3.17
Ordinary Urea (3-split)	30,688	30,688	97,472	1,02,321	71,633	66,784	3.33	3.18
Neem Coated Urea (2-split)	30,674	30,674	99,862	1,04,722	74,048	69,188	3.41	3.26
Neem Coated Urea (3-split)	30,674	30,674	1,00,122	1,05,638	74,964	69,448	3.44	3.26
Nitrogen levels								
80% RDN (120 kg N/ha)	30,563	30,563	94,306	96,165	65,602	63,743	3.15	3.09
90% RDN (135 kg N/ha)	30,641	30,641	98,379	1,02,319	71,678	67,738	3.34	3.21
100% RDN (150 kg N/ha)	30,720	30,720	1,00,261	1,04,966	74,246	69,541	3.42	3.26
110% RDN (165 kg N/ha)	30,800	30,800	1,01,724	1,05,840	75,040	70,924	3.44	3.30

was obtained with application of three split application of neem coated urea (½ Basal + ¼ first irrigation + ¼ heading) while two split application of ordinary urea recorded significantly lowest benefit: cost ratio than rest of the treatments. In general benefit: cost ratio varied from 3.15 to 3.44 in both the years of experimentation.

Cost of cultivation of wheat increased with the increasing levels of nitrogen. Among all the four nitrogen levels, application of 110 % RDN resulted in higher gross and net returns of wheat in both the years. This might be due to the better vegetative growth and development resulting in higher yield of wheat by more nutrients application. Similarily application of 110 % RDN produced significantly higher B: C of wheat than rest three treatments (80, 90 and 100 % RDN). Increase in nitrogen level increased the B: C of wheat, being lowest with the application of 80% RDN in the year 2017-18 (3.09) and highest with the application of 110% RDN in the year 2016-17(3.44). This increase in B: C of wheat might be due better yield attributing characters and yield of wheat which were also significantly higher with higher levels of nitrogen application. Suresh and Swarna (2008) studies that the bio-efficacy of neem coated urea on rice resulted the highest B-C ratio of 1.61 rupees per rupee invested was recorded over the normal recommended practice of applying urea at the rate of 120 kg N ha^{-1} in 3 splits and found economically viable (Suresh and Swarna , 2008).

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