



## Performance of Adjuvant on Irrigation Water and Crop Yield

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### Abstract

There are some adjuvant which decrease the surface tension of water and retain the moisture content for longer duration by reducing evaporation, percolation losses and runoff. The field experiment with All Purpose Spray Adjuvant (APSA)-80 was carried to observe the effect on irrigation water and crop yield. The saving of irrigation water and increase in yield for various crops were found to be 5-15% and 20-35%, respectively. On the basis of encouraging experimental results, the study was also conducted to survey the performance of APSA-80 on irrigation water and crop yield at different districts of Punjab. The increase in crop yield and irrigation water saving with APSA-80 were found to be 15%, 12%, 10%, 8% and 17%, 15%, 15% and 12% for rice, wheat, potato and sugarcane crops, respectively. The economic analysis of APSA-80 used in irrigation, herbicide and pesticide for rice and wheat crops was also computed. The benefit cost ratio for application of APSA-80 for wheat and rice crops was computed and found to be ₹ 6 and ₹ 10, respectively. It revealed that on the expenditure of ₹ 1 on APSA-80, the farmers are getting profit of ₹ 6 and 10 for rice and wheat crops, respectively. The performance of APSA-80 used by the farmers was found satisfactory and economically viable.

**Key words:** Adjuvant, APSA-80, Irrigation water, Performance, Percolation losses, Crop yield

### Introduction

The utilizable surface water resources are 69 million ha m out of which the live storage created and projects under construction and consideration amount to 38.44 million ha m. Net irrigated area through surface water resources, wells and other sources is about 57.4 million ha out of total net sown area of 143 million ha. Surface water resources of Punjab state at canal head works is 1.79 million ha m. After accounting for seepage losses in the canal network the surface water available at the outlet works out to be 1.45 million ha m. The utilizable ground water resource of Punjab state is 1.68 million ha m. The total annual water resources become 3.13 million ha m (Chawla and Kaushal, 2005). The efficient utilization of irrigation water is thus necessary to increase the area under irrigation and productivity. Irrigation requirement depends upon type of crop, season and weather factor, soil type and appropriate irrigation system used. More than 80 per cent of rainfall occurs in monsoon season is erratic over time and space.

Irrigation water saving and getting high crop yield is the major objective and emphasis of the

agricultural scientists, officers and decision makers. There are some adjuvants which decrease the surface tension of water and retain the moisture content for longer duration by reducing evaporation and percolation losses. Adjuvant mixed with pesticides (insecticides, fungicides and post emergent herbicides) to enhance effectiveness to control insects, disease and weed and also mixed with water to control runoff, evaporation and percolation. Adjuvant when used with pesticide and fertilizers, increases the effectiveness, saves quantity of fertilizer and pesticides to be sprayed leading to an increase in crop yields. All-purpose spray adjuvant-80 (APSA-80) is a substance added with pesticide, insecticide, herbicide and fertilizer into the spray tank which modifies the performance and physical properties of spray mixture or both. The right adjuvant may reduce spray application problems there by improving overall pesticide efficiency thus, offering farmers an excellent opportunity to increase their crop yields. They may also improve the environmental and organic behaviour of pesticides in a number of different ways such as protecting against poor weather especially cold

temperature condition, reducing drift by increasing spray droplets size, reducing losses due to rain that washes from crop leave, increasing retention of the pesticide on the plant, increasing chemical activity of pesticide, clean spray equipment and prevents clogged nozzles, etc. (Dhanoa, 2008).

APSA-80 aids in irrigation by increasing the rate at which water soaks into the soil. It promotes more efficient water usage, helps in better utilization of water available for irrigation resulting in better crop health and saving in water, electricity and time. APSA-80 contains surfactants which break down the surface tension of water based solution thus, increasing the wettability of the leaf surface which spread the pesticide more evenly over the crop. It is available in a concentrated formula that includes 80% active ingredients. The concentrated formula improves the pesticide performance for enhancing crop yields. The application of adjuvant has been tested and proven to be effective on all crops like rice, soybean, corn and wheat, orange, apple, grapes, peaches, mangoes, pears, bananas and tomatoes, cabbage, carrots, pea pods, spinach, pepper and cauliflower, etc. Rice and wheat are widely cultivated crops in most part of Punjab which are the important grains with regard to human feed. Both are the high water requirement crops leading to decrease in ground water table in some parts of the state. Due to this the farmers are advised for diversification of crops by the scientists and government too. The farmers are using adjuvant as irrigation aid and mixing with pesticides and fertilizers resulted in saving of water, fertilizers, time, energy and enhancing crop yield. The present study was carried out to evaluate the performance of APSA-80 on irrigation water and crop yield and the economic analysis of APSA-80 was also computed for rice and wheat crop. The application of adjuvant has been evaluated and proven to be effective on all crops like rice, soybean, corn and wheat, orange, apple, grapes, peaches, mangoes, pears, bananas and tomatoes, cabbage, carrots, pea pods, spinach, pepper and cauliflower, etc. Kerala Agricultural University tested the application of Carbenzadim insecticides in combination with APSA-80 shows 6.5% reduction of leaf spot infection resulted in 9%

increase in crop yield while application of APSA-80 with Chlorpynipilos showed 100% reduction of Pseudo stem Boru attack resulted in 23% increase in crop yield (Amagram, 2006). Mahatma Phule University, Jalgoan tested the application of APSA-80 on Soybean crop. Application of APSA-80 with Monocrotophos pesticides resulted in 37.76% increase in yield (Amagram, 2011). Konkan university Ratanagire, Maharashtra (Amagram, 2010) conducted experimental on cowpea crop using adjuvant as irrigation aid and found 100% irrigation water saving. The moisture content of the soil was recorded upto 36% higher and showed upto 51.7% increase in yield over the control field. The cost benefit analysis on the usage of adjuvant for cowpea showed with return of  $18.99$  per  $1$  spent for adjuvant. Singh *et al.* (2010) conducted field experiment at Research Farm of Department of Soil and Water Engineering, Punjab Agricultural University, Ludhiana to observe the effect of APSA-80 on irrigation water and yield of cauliflower crop. The saving in irrigation water and increase in crop yield was found to be about 6% and 36%, respectively. Tamil Nadu Agricultural university, Coimbatore (Amagram, 2009) tested adjuvant on Tomato crop for pesticide control resulted in better disease control with increase in yield up to 48%. When APSA-80 was used with fertilizer, pesticide, insecticide, herbicide and irrigation water then increase in yield of crops viz: cotton (19.2%), banana (23%), grape (27.1%), sugarcane (8.7%), potato (19.5%) was reported (Amagram, 2008). About 70 universities and independent test facilities and institutions tested APSA-80 on numerous crops and most soil types for more than 30 years and reported the use of APSA-80 is very beneficial for control of fungus, insects and saving in irrigation water (Amagram, 2007).

## Materials and Methods

The experiment on cauliflower crop was conducted at the Research Farm of the Department of Soil and Water Engineering, Punjab Agricultural University, Ludhiana under excess, normal and deficient irrigation condition. These irrigation conditions were categorized on the basis of irrigation period. The duration of irrigation for Excess, Normal and Deficit

condition was given 2, 1.5 and 1 minute, respectively. The amount of irrigation was applied to plot through Parshall flume with 11 cm head. Fertilizers and pesticides (Confidor) with and without APSA-80 at the recommended rate were applied for control treatments and without control treatments.

Survey was also conducted to evaluate the performance of APSA-80 used by the farmers in few districts of Punjab, viz. Ludhiana, Gurdaspur, Patiala, Sangrur, and Faridkot. The analysis was carried out for irrigation water saving and increase in crop yield with the application of APSA-80.

**Results and Discussion**

Irrigation water saving was obtained about 5.42%, 3.74% and 6.02% with the use of adjuvant under excess, normal and deficient irrigation conditions, respectively. The results show that there is more saving of water in deficient irrigation conditions as compared to normal and excess irrigation conditions. This is due to the fact that the application of adjuvant reduces surface tension which checks evaporation and percolation of water. The percentage increase in the yield with the use of adjuvant is reported to be 36.09%, 25.61% and 11.39% under excess, normal and deficient irrigation conditions, respectively. The percentage increase in yield was obtained under excess irrigation condition followed by normal and deficient irrigation condition (Fig. 1).

More than 70 farmers were investigated about the performance of APSA-80 on irrigation water and crop yield during survey. The percentage saving of irrigation water and increase in crop

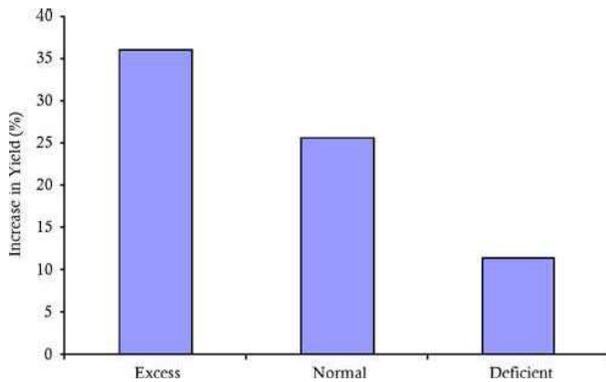


Fig. 1 Effect of adjuvant on increase in yield of cauliflower crop

yield was computed (Fig. 2 and 3), which depict that about 50 farmers reported less than 15% and 20 farmers said there was more than 15% water saving and increase in crop yield with application of APSA-80. The percentage water saving and increase in yield with the application of APSA-80 was reported in the range of 5-17%. The variations in the water saving and crop yield with APSA-80 reported by different farmers are due to lack of knowledge and awareness about the method of application of APSA-80 at different stages.

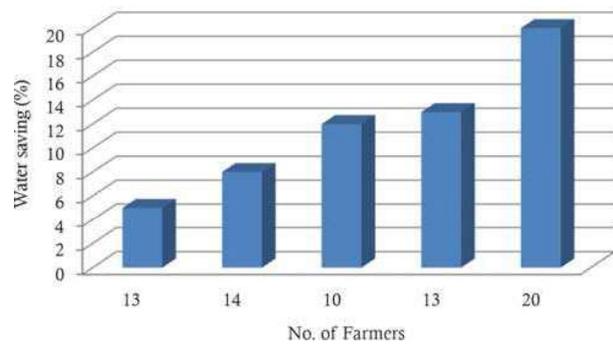


Fig. 2 Effect of APSA-80 on irrigation water

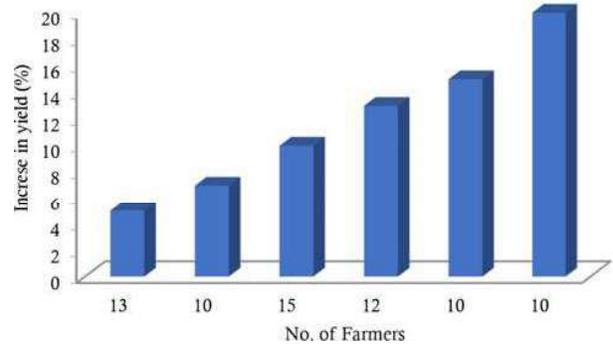


Fig. 3 Effect of APSA-80 on crop yield

Increase in crop yield and saving in irrigation water with the application of APSA-80 reported by different farmers were analysed. The higher percentage increase in yield and water saving was reported for rice crop, which is about 15% and 17%, respectively followed by wheat, potato and sugarcane (Table 1). This is due to the fact that more amounts of irrigation and fertilizer are required for rice and wheat crops. The effect of APSA-80 on increase in yield and water saving was found higher in rice crop and lower in sugarcane crop as stated by the farmers. It is due to the fact that lack of awareness about the

**Table 1.** Performance of APSA-80 on different crops

Type of crop	Increase in yield (%)	Water saving (%)
Wheat	12	15
Rice	15	17
Potato	10	15
Sugarcane	8	12

**Table 2.** Benefit cost ratio of APSA-80 for wheat and rice crop

S.No.	Crop	Amount of APSA-80 applied (1 ha <sup>-1</sup> )	Additional expenditure for APSA-80 (Price@ ₹ 1070 per litre)	Benefit (₹)	Benefit cost ratio
1.	Wheat	2.03	2,172	12,753	5.9
2.	Rice	1.63	1,744	17,652	10.0

application of APSA-80 on sugarcane crop and fear in more investment on APSA-80.

The economic analysis was also carried out for the use of APSA-80 for wheat and rice crop. The benefit-cost ratio of APSA-80 for wheat and rice crop was computed to be 5.9 and 10.0, respectively (Table 2). This table indicates that on the expenditure of ₹ 1 on APSA-80, farmers could get a benefit of about ₹ 6 and ₹ 10 for wheat and rice crops, respectively.

## Conclusions

It was concluded that due to application of APSA-80 the saving of irrigation water was highest in deficient irrigated plots followed by excess and normal irrigation conditions. The highest yield was obtained under normal irrigation conditions followed by deficient and excess irrigation condition with the application of APSA-80. The percentage of irrigation water saving and increased in yield of cauliflower crop was obtained as 5.42%, 3.74%, 6.02% and 36.09%, 25.61%, 11.39% for excess, normal and deficient irrigation conditions, respectively with the application of APSA-80.

According to survey report conducted among the farmers, the irrigation water saving and increase in crop yield with the application of APSA-80 was varied from 5- 20%. Increase in crop yield with APSA-80 was reported to be 15%, 12%, 10% and 8% for rice, wheat, potato and sugarcane, respectively. Irrigation water saving with APSA-

80 was 17%, 15%, 15% and 12% for rice, wheat, potato and sugarcane crops, respectively. The benefit cost ratio of APSA-80 for wheat and rice crop was computed and found to be ₹ 6 and ₹ 10, respectively. The farmers get a benefit of about ₹ 6 and ₹ 10 for wheat and rice crops, respectively on the expenditure of ₹ 1 on APSA-80. There could be saving in time and expenditure on diesel

for irrigation water given to both the crops. The application of APSA-80 is the need in concern of water saving and good returns to the farmers.

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