

## EFFECT OF CHEMICAL WATER RETAINER AND IRRIGATION ON THE GROWTH AND YIELD OF WHEAT

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### ABSTRACT

A modern wheat variety BARI GAM-19 (Sourov) was grown with six rates of flobond, a chemical water retainer, viz., 0.0, 0.5, 1.0, 2.0, 4.0 and 8.0 g pot<sup>-1</sup> under three levels of irrigation viz., control, one irrigation at 18 DAS (days after sowing), two irrigations at 18 DAS and 55 DAS, three irrigations at 18 DAS, 55 DAS and 80 DAS at the net house of the Department of Agronomy, Bangladesh Agricultural University, Mymensingh. Rate of flobond and irrigation level and their interaction exerted significant influence on yield, yield contributing and other crop characters. It was observed that the highest grain yield (3.06 t ha<sup>-1</sup>) was obtained with 2 g flobond pot<sup>-1</sup> (332 kg ha<sup>-1</sup>). It was the outcome of the highest effective tillers plant<sup>-1</sup> and highest number of grains spike<sup>-1</sup>. Grain yield showed an increasing trend up to 2 g flobond pot<sup>-1</sup> (332 kg ha<sup>-1</sup>) and thereafter, it may be identical. Considering, irrigation frequencies the highest grain yield (3.41 t ha<sup>-1</sup>) was obtained with two irrigations. Interaction of rate of flobond as chemical water retainer and level of irrigation had significant effect on yield, yield contributing and other crop characters except plant height, spike length, 1000-grain weight. However, the highest grain yield (3.58 t ha<sup>-1</sup>) was obtained with two irrigations coupled with 2 g flobond pot<sup>-1</sup> (332 kg ha<sup>-1</sup>) as chemical water retainer and the lowest one (1.37 t ha<sup>-1</sup>) was obtained in no flobond and no irrigation.

**Key words:** Flobond, irrigation, wheat, yield.

### Introduction

Wheat is one of the most important winter crops, is temperature sensitive and is the second most important grain after rice (Hossain, 2013). Bangladesh's wheat demand has doubled in the past decade. Production did not increase during this period. Instead, it decreased by about 20 percent. As a result, dependence on imports has increased significantly. This raises concerns about overall import costs and food security. Ten years ago (2013-14), the country's wheat production was 1.306 million tonnes. According to the Ministry of Food, the country currently has to import an average of 50-67 million tonnes of wheat and wheat products annually. Ten years ago (FY 2013-14), 3.3 million tonnes of wheat was imported. Currently, the cost of wheat in the country is between \$1.5 billion and \$2.5 billion (Daily industry, 2023). The low yield of wheat could be evaluated with the adoption of improved varieties along with the use of appropriate agronomic practices like judicious and intellectual application of irrigation water and chemical water retainers (Flobond/Aquasorb). Water plays a vital role in growth and development of wheat. It influences dry matter production, plant height, duration of grain filling and grain protein content of wheat (Thomson *et al.*, 1992). Application of irrigation water without proper planning based on actual requirement of the crops results not only in wastages of irrigation water but also hampers crop growth and yield (Sekhon *et al.*, 1968). Knowledge of the role of irrigation in growth and development of plant and the optimum time of application of water may help to economize the use of limited amount of water in obtaining the maximum yield of higher quality wheat. Again, the supply of irrigation water and preparing irrigation channel are

costly. So by using flobond, a chemical water retainer which is used to retain the water in the soil, keep the soil moist and reduce the frequency of irrigation. Flobond is a range of organic soil conditioner based on polyacrylamide (PAM). When the PAM dissolves in water, dissociation of the potassium ion exposes a negative site on the molecule at which the colloidal soil particles will be attached. So by using chemical water retainer like flobond farmers can conserve water, the scarce resource and also reduce the cost of production. With the above background, the present study was undertaken with flobond, a chemical water retainer with the following objectives: i) to find out the effectiveness of flobond on the growth and yield of wheat, ii) to find out the optimum rate of the flobond for yield maximization and iii) to determine the water requirement of wheat under flobond application.

### Materials and Methods

A pot experiment was conducted at the Net house of Department of Agronomy, Bangladesh Agricultural University, Mymensingh to study the effects of rate of flobond and level of irrigation on the growth and yield of wheat cv. BARI GAM-19 (Sourov). The experiment comprised of two factors (a) rate of flobond viz., 0, 0.5, 1.0, 2.0, 4.0 and 8.0 g pot<sup>-1</sup> and (b) three level of irrigation viz. control, one irrigation at 18 DAS, two irrigation at 18 and 55 DAS, three irrigation at 18, 55 and 80 DAS. The experiment was laid out in a completely randomized design with three replications. The total numbers of experimental pot were 72 (6 x 4 x 3). The depth and diameter of each pot was 16.5 and 27.0 cm, respectively. The soils were collected from different location from Agronomy field laboratory. Then each pot was fertilized with urea, triple superphosphate, muriate of potash and zinc sulphate @ 1.25 g, 1.0g, 1.39g and 0.28 g pot<sup>-1</sup>. Triple super phosphate, muriate of potash, zinc sulphate and two-thirds urea were applied as basal dose i.e. mixed with soil before putting into pots. Rest one-thirds urea was applied at first irrigation. The soils were then divided into six groups and water retaining chemical; Flobond was applied in each group as per treatment. A total of 72 pots were filled up with soil (6 kg pot<sup>-1</sup>) followed by leveling. Five seeds were sown in each pot. Irrigation also applied as per treatment and care should be taken as when as necessary. Weeding and pest management were done as when as necessary. At maturity yield, yield contributing and other crop characters were recorded. Three plants from each pot were uprooted for recording necessary data. The data on different yield, yield contributing and other crop characters were recorded from each pot. Data were analyzed using the "Analysis of Variance" technique and mean difference were recognized by DMRT.

### Results and Discussion

Rate of flobond had significant effects on most of the yield and yield parameters of wheat. The number of total tillers plant<sup>-1</sup> (4.99), number of effective tillers plant<sup>-1</sup> (4.08), number of grains spike<sup>-1</sup> (44.99) and grain yield (21.38 g pot<sup>-1</sup>/3.06 t ha<sup>-1</sup>) were found highest with 2 g flobond pot<sup>-1</sup> (332 kg ha<sup>-1</sup>). Spike length (9.15cm) were highest with 4 g flobond pot<sup>-1</sup> (664 kg ha<sup>-1</sup>). On the other hand, all parameters except spike length (8.88 cm) were lowest with no flobond (Table 1).

Irrigation had significant effects on all most all the yield, yield contributing characters except plant height, spike length and 1000-grain weight. Spike length (9.06cm), number of total tillers plant<sup>-1</sup> (5.78), grains spike<sup>-1</sup> (46.54) and grain yield (23.88 g pot<sup>-1</sup>/3.41 t ha<sup>-1</sup>) were highest with two irrigations treatment. Only 1000-grain weight (44.41 g) and effective tillers plant<sup>-1</sup> (4.59) were highest under three irrigations. The entire yield, yield contributing and other crop characters except spike length (8.84 cm) was lowest with no irrigation. The highest grain yield (23.88 g pot<sup>-1</sup>/3.41 t ha<sup>-1</sup>) was obtained with two irrigations and the lowest grain yield (13.65 g pot<sup>-1</sup>/1.95 t ha<sup>-1</sup>) was obtained with no irrigation (Table 2). There was no significant difference within the levels of irrigation. The findings of Nayak and Sengupta (1981), regarding plant height was that mature plant did not so response to irrigation frequencies. Rahman *et al.* (1991) observed the highest yield wheat along with maximum irrigation efficiency when two irrigations were given at tillering and booting stages and the lowest grain yield was obtained in treatments receiving either no irrigation or only on irrigation at grain filling stage. Naser (1996) reported that two irrigations at 30 and 50 DAS significantly increased grain and straw yields over control.

Table 1. Effect of rate of flobond on different yield, yield contributing and other crop characters of wheat cv. Sourov

Rate of flobond (g pot <sup>-1</sup> )	Plant height (cm)	No. of total tillers plant <sup>-1</sup>	No. of effective tillers plant <sup>-1</sup>	Spike length (cm)	No. of grains spike <sup>-1</sup>	1000-grain weight (g)	Grain yield (t ha <sup>-1</sup> )
0	70.24bc	3.71 d	3.06d	8.88ab	34.35b	41.47	1.90d
0.5	69.82c	4.45bc	3.08d	8.58b	42.26a	42.60	2.54c
1.0	70.66bc	4.98a	3.55bc	8.53b	42.47a	42.64	2.75b
2.0	71.98abc	4.99a	4.08a	9.12a	44.99a	46.28	3.06a
4.0	74.17a	4.08cd	3.26cd	9.15a	44.90a	46.80	2.96a
8.0	73.42ab	4.67ab	3.84ab	9.11a	44.96a	46.81	2.98a
S $\bar{x}$	1.06	0.14	0.13	0.13	1.54	0.38	0.04
Level of sig.	0.01	0.01	0.01	0.01	0.01	NS	0.01

Table 2. Effect of level of irrigation on different yield, yield contributing and other crop characters of wheat cv. Sourov

Level of irrigation	Plant height (cm)	No. of total tillers plant <sup>-1</sup>	No. of effective tillers plant <sup>-1</sup>	Spike length (cm)	No. of grains spike <sup>-1</sup>	1000-grain weight (g)	Grain yield (t ha <sup>-1</sup> )
0	71.00	2.56d	1.55c	8.84	39.14bc	43.87	1.95d
1	71.04	4.25c	3.26b	8.80	40.37bc	44.35	2.57c
2	71.78	5.78a	4.5 1a	9.06	6.54a	44.41	3.41a
3	72.47	5.31b	4.59a	8.89	43.23ab	44.41	3.15b
S $\bar{x}$	0.86	0.11	0.11	0.11	1.26	0.31	0.04
Level of sig.	NS	0.01	0.01	NS	0.05	0.01	0.01

Table 3. Interaction effect of flobond and level of irrigation on growth and yield of wheat cv. Sourov

Interaction (rate of flobond × level of irrigation)	Plant height (cm)	No. of total tillers plant <sup>-1</sup>	No. of effective tillers plant <sup>-1</sup>	Spike length (cm)	No. of grains spike <sup>-1</sup>	1000-grain weight (g)	Grain yield (t ha <sup>-1</sup> )
F <sub>1</sub> I <sub>0</sub>	66.49	1.98j	1.52hi	8.50	17.78k	39.92	1.37i
F <sub>1</sub> I <sub>1</sub>	70.03	3.16h	2.22fgh	9.17	41.90d-h	40.38	1.87h
F <sub>1</sub> I <sub>2</sub>	72.27	5.34cde	3.75cd	9.17	36.35f-i	42.44	3.01d
F <sub>1</sub> I <sub>3</sub>	72.17	4.16g	3.78cd	8.67	41.39d-h	43.16	3.05cd
F <sub>2</sub> I <sub>0</sub>	72.76	2.90hi	1.30i	9.55	41.71d-h	44.67	2.08gh
F <sub>2</sub> I <sub>1</sub>	68.14	4.11g	2.65ef	8.95	29.16ij	41.90	2.39ef
F <sub>2</sub> I <sub>2</sub>	68.43	5.44b-e	3.22de	8.97	48.71a-e	42.19	3.15bcd
F <sub>2</sub> I <sub>3</sub>	69.43	5.33cde	4.93ab	8.95	49.45a-e	41.63	3.12bcd
F <sub>3</sub> I <sub>0</sub>	74.17	3.02h	1.53hi	7.39	44.75b-f	41.95	1.42i
F <sub>3</sub> I <sub>1</sub>	69.07	4.63efg	2.54efg	8.89	49.96a-d	41.54	2.34efg
F <sub>3</sub> I <sub>2</sub>	70.64	6.15abc	5.11 a	9.03	33.74ghi	43.50	3.36ab
F <sub>3</sub> I <sub>3</sub>	70.77	6.11abc	4.91ab	8.83	41.41d-h	43.58	3.01d
F <sub>4</sub> I <sub>0</sub>	70.22	2.17ij	1.53hi	9.60	46.34b-f	45.90	2.49e
F <sub>4</sub> I <sub>1</sub>	71.40	5.29cde	4.87ab	8.90	52.99abc	46.82	2.89d
F <sub>4</sub> I <sub>2</sub>	72.06	6.36a	4.80ab	8.97	56.98a	45.76	3.58a
F <sub>4</sub> I <sub>3</sub>	74.25	6.25ab	5.23a	9.02	23.63jk	46.66	3.31abc
F <sub>5</sub> I <sub>0</sub>	73.57	3.07h	1.77ghi	8.63	43.10c-g	46.83	2.14fg
F <sub>5</sub> I <sub>1</sub>	73.60	4.06g	3.5 1 cd	8.58	50.24a-d	46.86	2.93d
F <sub>5</sub> I <sub>2</sub>	73.69	5.05def	4.11 bc	8.77	39.32e-h	45.92	3.46a
F <sub>6</sub> I <sub>3</sub>	75.80	4.16g	3.66cd	8.34	46.95a-e	47.59	3.31abc
F <sub>6</sub> I <sub>0</sub>	74.19	2.21 ij	1.66hi	9.34	48.55a-o	46.82	2.20fg
F <sub>6</sub> I <sub>1</sub>	74.00	4.26fg	3.78cd	8.22	55.01ab	45.76	3.01d
F <sub>6</sub> I <sub>2</sub>	71.51	6.35a	4.93ab	9.44	44.27c-f	46.66	3.53a
F <sub>6</sub> I <sub>3</sub>	73.98	5.84a-d	4.99a	9.61	32.00hij	48.83	3.12bcd
S $\bar{x}$	2.11	0.27	0.26	0.26	3.08	0.76	0.09
Level of sig.	NS	0.01	0.01	NS	0.01	NS	0.01

NS = Not significant, Level of sig. = Level of significance

In a column figures with same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as adjudged by DMRT

Interaction of rate of flobond and level of irrigation was significant for yield and yield contributing characters except plant height and 1000-grain weight. The highest grain yield (25.04 g pot<sup>-1</sup>/ 3.58 t ha<sup>-1</sup>) was obtained with 2 g flobond pot<sup>-1</sup> (332 kg ha<sup>-1</sup>) under two irrigations, which was statistically identical with 4 g flobond pot<sup>-1</sup> (664 kg ha<sup>-1</sup>) under two irrigations (24.20 g pot<sup>-1</sup>/3.46 t ha<sup>-1</sup>) and 8 g flobond pot<sup>-1</sup> (1324 kg ha<sup>-1</sup>) under two irrigation levels (24.68 g pot<sup>-1</sup>/ 3.53 t ha<sup>-1</sup>). The lowest grain yield of wheat (9.56 g pot<sup>-1</sup>/1.37 t ha<sup>-1</sup>) was obtained in no flobond and no irrigation, which was statistically identical with 1 g flobond pot<sup>-1</sup> (166 kg ha) and no irrigation (9.96 g pot<sup>-1</sup>/1.42 t ha<sup>-1</sup>). The grains spike<sup>-1</sup> (56.98) and number of total tillers plant<sup>-1</sup> (6.36) was higher with 2 g flobond pot<sup>-1</sup> (332 kg ha<sup>-1</sup>) with two irrigations (Table 3). Most of the yield, yield contributing and other crop characters were lowest in no flobond and no irrigation (Table 3). Interaction level of irrigation and rate of flobond was studied by Rahman et al. (2019) obtained significant growth, yield and yield contributing characters except plant height under eight irrigations combined with 10 gm flobond.

### Conclusion

From the study it may be concluded that the performance of 2 g flobond pot<sup>-1</sup> (332 kg ha<sup>-1</sup>) under two irrigations was the best in respect of total tillers plant<sup>-1</sup> (6.36), grains spike<sup>-1</sup> (56.98) and grain yield of wheat (25.04 g pot<sup>-1</sup>/3.58 t ha<sup>-1</sup>).

### Recommendation

Flobond as a soil chemical water retainer may be promoted in Bangladesh agriculture in order to economies water use efficiency and increase the production of wheat.

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