https://doi.org/10.29321/MAJ.10.A02511

Madras Agric. J. 71 (3) 530-533 August 1984.

ROLE OF GROWTH REGULATORS ON NUTRITIONAL COMPOSITION OF GRAIN SORGHUM

BHOSALE A. N. *

Significant increase in the grain yield and improvement in the nutritional composition of sorghum grains were obtained when the crop was sprayed with 4 growth regulators viz 2, 4-D, simazine, cycocel and atrataf. While, 2, 4-D and simaziue increased the grain yield to the maximum extent, the foliar sprays of cycocel, atrataf (and simazine) proved to be most effective in improving the nutritional composition of sorghum grains.

Plant growth hormones and their chemical analogues have been known to influence plant processes, including the protein synthesis. The effects of herbicides such as S-triazine compouuds on biochemical events like activities of enzymes relating to nitrogen and carbohydrate metabolism are being elucidated (Wu and Salunkhe, 1974 and Desai and Khanvilkar, 1977). The bioregulation of nutritional composition of plant products, achieved through control of specific metabolic pathways by externally supplied synthetic growth substances can be of a great practical value for developing a new technology to slove the food and nutritional problems.

Most of the studies reported so far are only indicative and experimental nature. Further studies are needed in search for more powerful and less expensive chemicals. The confirmation of the preliminary concepts regarding the role of growth substances will require unequivocal demonstration of increases in yield and improvement in quality of plant products when they are treated with chemical growth regulators.

Sorghum has been a major source of food for millions of people in the less developed countries of Asia and Africa. Improvement of yield and quality of food crops like sorghum offers an excellent opportunity for mitigating the protein hunger in this region. The effect of 4 growth substances viz, 2-4-D, simazine, cycocel and atrataf on the yield and quality of 3 grain sorghums was therefore studied under pot-culture conditions.

MATERIALS AND METHODS

The seeds of 3 sorghum cvs. (*Sorghum bicolor L.*) viz, CS-3541, IS-11758 and Gulbhendi, obtained from the Sorghum Breeder, Mahatma Phule Agricultural University, Rahuri, were grown in pots under green house conditions during the *Kharif* season of 1978. The medium black calcareous soil collected from the central farm of the Mahatma Phule Agricultual Unirversity, Rahuri, was

* Soil Engineer, Dry Farming Research Station, Post Box No. 607, Solapur-413 002.

fertilized with 1.10 g N, 0.55 g P and 0.55 g K per pot (10 kg soil) in the form of urea, superphosphate and muriate of potash respectively and used for the experiment.

Four growth regulators and their concentrations used were as follows:

1. 2, 4-dichlorophenoxy acetic acid (2, 4-D), 100 ppm (4.52×10^{-4}M).
2. Simazine, 50 ppm (1.00×10^{-4}M).
3. (2-Chloroethyl)-trimethyl ammonium chloride (cycocel or CCC) 2000 ppm (1.27×10^{-2} M).

Atrataf. 50 ppm (4.64×10^{-4}M).

The concentrations of the growth regulators used were such that they were effective physiologically (Desai and Khanvilkar, 1977). The crop was sprayed with respective growth regulator solutions after full anthesis and 10 days thereafter until maturity (3 sprayings). Five growth regulator treatments, including the control (distilled water) with 3 cvs. of grain sorghum were replicated 3 times in a completely randomised design. Three plants were grown in each pot. Care was taken to irrigate the pots as and when required and to control the pests and diseases.

Analytical methods :

The moisture, crude protein, true protein, crude fat (ether extract), crude fibre, ash, P and K in grains of sorghum were estimated by following standard procedures described in A. O. A. C. (1975). The P was determined by vanado-molybdate yellow colour method (Jackson, 1958). The total carbohydrates were obtained by difference i. e. by substraction of the total of all the constituents from 100.

RESULTS AND DISCUSSION

The foliar spray of 4 growth regulators viz, 2, 4-D, simazine, cycocel and atrataf significantly influenced both the grain yield and chemical composition of sorghum grains (Table). The 2, 4-D treatment, followed by simazine, increased the grain yield to the highest extent. While all the chemical treatments significantly enhanced the crude and true proteins, soluble sugars, fat and mineral matter content of sorghum grains; the total carbohydrate and the fibre contents decreased significantly ($P=0.01$). The most effective treatments enhancing the protein content were simazine for crude protein (11.40 to 14.43%) and cycocel for true protein (8.76 to 11.48%). About 76 to 80% of the total protein of sorghum grain was a true protein fraction

Atrataf followed by cycocel increased the contents of soluble sugars and crude fat most significantly. The total mineral matter (ash), P and K contents of sorghum grain were also enhanced significantly; cycocel and simazine were the most effective treatments in this respect.

It is of interest to note that there was a significant reduction in the contents of crude fibre (1.73 to 1.12%) due to atrataf and in total carbohydrates (73.93 to 67.88%) due to simazine treatment.

Table :- Influences of growth hormones on the nutritional composition and yield of sorghum grains[1]

Constitutents%	Growth regulator treatments					S.Em (+)	LSD (P=0.01)
	Control	2, 4-D	Simazine	Cycocel	Atratef		
Total protein	11.40	13.45	14.43	13.27	13.42	0.33**	1 280
True protein	8 76	11.28	11.36	11.48	11.08	0.36**	1.396
Soluble sugars	2.53	3.17	4.13	4.80	4.93	0.34**	1.32
Total carbohydrates	73 93	70.71	68.51	67.88	71.19	0.42**	1.633
Fat	3.62	4.21	3.95	4.30	4.57	0.05**	0.190
Fibre	1.73	1.28	1.27	1.37	1.12	0.05**	0.190
Ash	1.81	2.10	2.29	2.38	2.13	0.05**	0.190
Phosphorus	0.93	1.18	1.28	1.28	1.26	0.023**	0.089
Potassium	0.29	0.38	0.48	0.40	0.45	0.010**	0.038
Grain yield (g/pot)	7.51	13.02	11.36	9.53	9.43	0.86**	3.34

1. The figures are average of 3 replication and 3 cvs. of sorghum.
** = Significant at P = 0.01 S.Em. (+) = Standard error of treatment means.

The enhancement in the grain yield and protein content of crop plants in response to the foliar sprays of growth regulator chemicals have been reported Patil and Kale,(1975) Gill *et al.* (1976) and Desai and Khanvilkar (1977). 2, 4-D probably acts on the protein portion of an enzyme and influences the nucleic acid metabolism causing an increase in the contents of nucleic acids and protein (Key *et al.* 1967 and Moore, 1980) Freiberg and Clark (1952) attributed the effects of 2, 4-D to the redistribution of nitrogen within the plant. The proteases and peptidases were influenced and were more active in stems and leaves where more protein was synthesized. Singh and Salunkhe (1970) demonstrated that foliar sprays of 5 ppm of S-triazine compounds on bean plants increased the activities of nitratereductase, adenosine triphosphatase, phosphorylase, transaminase and alpha-amylase. The significant increase observed in the grain yield protein content and other nutritional components of sorghum grain may be ascribed to the probable effects of growth chemicals on the activities of enzymes such as nitrate reductase glutamate dehydrogenase and transaminases required to produce more amino acids for the increased protein synthesis (Wu and Salunkhe, 1974) The stimulation of hydrolytic enzymes like starch phosphorylase and alpha amylase in response to the growth regulator treatment such as 2, 4-D (Wort and Cowie, 1953), could account for the significant decreases in the contents of total carbohydrate and crude fibre. It can be inferred from the results obtained that the yield and nutritional composition of grain sorghum can be improved by foliar sprays of growth substances

REFERENCES

AOAC 1975. Official Methods of AnalysisAssociation of Official Agricultural Chemists, Washington D. C.

DESAI, B. B. and KHANVILKAR, S. G. 1977. Improvement of protein quality and nutritional composition of bengal gram. Legume Res.1 (1) : 43-48.

FREIBERG, S. R. and CLARK, H. E. 1952. Bot. Gaz. 113 : 322-333. Quoted in 'The Physiology and Biochem)stry of Herbicides' L. J. Adus ed. Ist Academic Press, London PP 291-334 (1969).

GILL, A. S., SINGH, M. MUNNIKAR M. N. D. and ABICHANDANI, C. T. 1976. Effect of cycocel on growth and seed yield of *Sorghum bicolor*, L. Indian J. Agron. 21 (4) : 486-487.

JACKSON, M. L 1958. Soil Chemical Analysis Prentice Hall Inc.N. J. USA.

KEY, J. L., BARNETT, N. M. and LIN, C. Y. 1967. RNA and protein biosynthesis and the regulation of cell elongation by auxin. Ann. New Yark Acad. Sci. 144 : 49-62.

MOORE, T. C. 1980. Biochemistry and Physiology of plant Hormones. Narosa publishing House, New Delhi, 32-85.

PATIL, V. A. and KALE, V. R. 1975. Yield and protein content of wheat verieties as influecced by sub-lethal doses of herbicides. Qual. Plant Pl. Fds. Human Nutr. 25 (2) : 187-192.

SINGH, B. and SALUNKHE, 1970. Some metabolic response of bush bean plants to a Subherbicidal concentration of certain S-triazine compounds. Canad. J. Bot. 48 : 2213-2217.

WORT, D. J. and COWIE, L. M. 1963. The effec of 2, 4-D on phosphorylase, phosphatase amylase catalase and peroxidase activity in wheat. Plant Physiol , 28 : 135-139,

WU, M. T. and SALUNKHE, D. K. 1974. Storage processing and nutritional qualities of fruits and vegetables. C. R. C. Press. PP 79-118.