BENEDYNE, A NEW SYNTHETIC SOIL AGGREGATING CHEMICAL AND PLANT GROWTH STIMULANT FOR INCREASING CROP PRODUCTION: TRIALS WITH WHEAT

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THE role of physical condition of soil in increasing crop production is well recognised. Maintenance of good physical condition means mainly creation of soil environment that is conducive to proper growth and functioning of micro-organisms, aeration of soil through improvement in aggregation, increased intake of irrigation or rain-water and better retention of moisture thus received in the root zone and finally greater availability of soil moisture to the crop plants.

Traditionally organic matter has been used to improve soil physical condition in most cases. It is only recently that certain chemical substances have been put in the market which, even when applied in comparatively minute quantities, bring about very significant improvement in soil aggregation and other physical conditions of the soil and thus help to increase soil productivity. Benedyne (NF-42), an organic liquid concentrate derived from the controlled fermentation of natural organic matter, is one such chemical which is claimed to have been used with great advantage in crop production by the manufacturers, Messrs. United Soil Builders of California, U.S.A. Within its water base benedyne is reported to contain various biochemical substances of a micro-organic nature, which include soil micro-organisms and natural growth factors. These substances work with existing soil constituents to effect improved granular soil structure Benedyne's living soil micro-organisms and other organic substances accelerate and encourage the natural activities of micro-organisms already present in the soil. These micro-organisms play an essential role between the soil constituents and growing plants, providing assimilable nutrients to the plant and improving the structure of the soil. Benedyne benefits plant growth by making greater amounts of micro-nutrients and mineral elements available to plants through the stimulation of the soil's micro-organic activities. These biological activities also create an environment which allows air, water and nutritional elements to get to the roots of the plant. The soils must contain sufficient humus and plant food elements for best benedyne results. If the soil is deficient in these elements, it is recommended to be treated with a balanced organic or inorganic fertilizer, along with any necessary soil amendment. Benedyne, plus a normal soil programme of fertilization and irrigation, is reported to bring out the full potential of any soil.

Benedyne was first received in the year 1965 and was tried in a field experiment on wheat conducted during rabi 1965-66. The results which turned out to be encouraging are reported here.

The experiment was conducted in light sandy soil with medium fertility at the farm of the Division of Agronomy, Indian Agricultural Research Institute, New Delhi. The chemical composition of the soil (0-15 cm.) prior to sowing and application of manures and fertilizers showed 0·48% organic carbon with 198 kg. available N, 15 kg. available P_2O_5 and 227 kg. available K_2O per hectare, with soluble salts 0·30 m. mhos./cm. and a pH of 7·8. The effect of benedyne (305 ml. per square meter) was investigated with farmyard manure (100 q./ha.) and a combination of ammonium sulphate, single superphosphate and muriate of potash at the rate of 50 kg. N, 25 kg. P_2O_5 and 50 kg. K_2O per hectare in a randomized block design. This was fairly approximating the NPK content of the farmyard manure used in the other treatments. Following the application of test material and the fertilizers to each plot treatmentwise the entire field was irrigated. Wheat variety N.P. 718 was sown on 20th November 1965 in rows 18 cm. apart after necessary field preparation.

Data on grain and straw yield as well as on degree of soil aggregation are presented in Table I.

It may be noted that the effect of benedyne was quite marked when it was applied with organic manure. An increase of 34·3% and 37·2% in the yields of grain and straw respectively over farmyard manure alone was found to be statistically significant. On the other hand, when benedyne was applied with inorganic fertilizers, there was a reduction in the yields

TABLE I
Effect of Benedyne on yield of wheat and soil aggregation

Sl. No.	Treatment	Yield of wheat (q./ha.) Grain	Straw	Soil aggregates >0·25 mm. %
1	Farmyard manure	20·24	34·98	21·17
2	Farmyard manure + Benedyne	27·17	48·01	26·43
3	Inorganic fertilizers	31·36	55·46	20·76
4	Inorganic fertilizers + Benedyne	28·01	51·00	17·78
	S.Em.	± 1·31	± 3·06	±2·29
	C.D. at 5%	4·53	10·58	N.S.
	C.D. at 1%		5·82	13·59

of grain and straw to the extent of 10·7% and 8·2% respectively as compared to inorganic fertilizers alone.

Soil aggregation analysis revealed that benedyne and farmyard manure resulted in maximum soil aggregation thereby suggesting that the increase in the yield of crop was ascribable mainly to the physical condition of the soil resulting from the application of the test material and organic manure. More intensive investigation to assess the effect of Benedyne on the physical condition of the soil and the increase in crop yield resulting from such improvement in soil structure is under investigation.

THE INHIBITORY ACTION OF ALLOXAN IN THE EARLY DEVELOPMENT OF CHICK EMBRYO

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ALLOXAN-INDUCED maternal diabetes in animals has been studied by several investigators and various incidences of congenital malformations have been recorded.[1-3] Still there is no agreed opinion on the mechanism of action of alloxan in tissue metabolism, although the drug is known as an oxidising agent for thiols[4] and may therefore disturb the –SH metabolism of the embryos.[5] It was, therefore, felt desirable to study the action of alloxan on the early morphogenesis of chick embryos, and the reversal of its action by supplying the embryos with –SH groups.

The eggs were obtained from a white leghorn. After an initial incubation of 14 hours at 37·5° C., they were explanted *in vitro*.[6] Alloxan of concentration M/50 was applied directly on the ventral surface of the embryo. After treatment, the embryos were grown further for six hours. They were then washed carefully to remove all traces of alloxan. 0·1 ml. of fresh Pannett Compton solution was added and the embryos were incubated for further 20–21 hours. In the second set of experiments, the alloxan was removed after a six-hour treatment as described above and glutathione (–SH groups) was added inside the ring and the embryos were developed further.

In all 100 embryos were used in the present investigation of which 50 were treated with alloxan alone and 30 with alloxan followed by glutathione. The remaining 20 embryos received no chemical treatment. Alloxan treated embryos showed abnormalities mainly in the brain region and neural tube, the latter remaining widely open along most of its length and the brain showing little or no differentiation into vesicles (Fig. A). Several sections of control and treated embryos confirmed that the neural tube in the treated embryo was wide open (Fig. B). The neural folds had formed but failed to meet and fuse in the mid-line.

Reversal with Glutathione.—Two concentrations of glutathione were used ($5 \cdot 10^{-4}$ M and $4 \cdot 10^{-4}$ M). With each of these concentrations, the embryos were completely protected and resembled in every respect the controls (Figs. C and D).

Alloxan is suggested as an oxidising agent for thiols.[4] Administration of thiols (cysteine, glutathione, etc.) protects the embryos from alloxan diabetes, thereby indicating the importance of thiol groups in diabetes.[7,8] Lazarrow[8] believes that beta cells of pancreas are rich in –SH groups, which are necessary for the synthesis of insulin. Alloxan, by combining with those of –SH groups or oxidising them, would depress the insulin formation. The above results indicate that, for the normal growth and differentiation of the brain and