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Dear Mr. Delgado:

The submitted A and B plant samples from the circle sources turned out to be extremely interesting. Both circle samples disclosed unexpected and unusual characteristics which may lead to a broader understanding of the energetics involved in the circle formations. Before delving into specific details there are several general comments I would like to make, the most important being - the results discussed here should be considered of a preliminary nature. It will be necessary if at all possible to confirm these findings with fresh plant tissue and seeds obtained during the 1991 growing season. If you can work it out with the farmers we should obtain samples from a given circle at various stages of the crop development (along with their controls). We will also hope that the circles again form in other crops such as rape and corn.

As you will note in the following sections the plants in the circles did not develop in a normal manner even though their external appearance was no different than the controls. It appears from these preliminary data that the stage of growth at which the circle is produced has a marked influence on the "post-circle" morphogenesis of the plant system.

WHEAT HEADS - CIRCLE A

The first cursory view or impression one gets from the seed heads and glumes from within the circle is a situation of normal development. Outwardly the glumes appeared to be filled out to the same degree as those on the control plants. This did not prove to be the case - all of the glumes from the heads within the circle were empty of seeds. This is not, however, the end of the story.

On further examination a condition known as "polyembryony" was observed in over 90% of the glumes. Polyembryony is an uncommon genetic aberration and is manifested as the formation of multiple embryos within a single glume. The endosperm does not form, therefore they are not seeds. The enclosed photograph will give you a better understanding of the difference between these polyembryony formations and normal, control seeds from outside the circle (incidentally I am not proud of this photo - it was taken in a hurry and I intend to send you better copies at a later date). There are several intracellular alterations which can lead to polyembryony, however, for now I will not delve into these cytological details.

There were two heads in the package from circle-A, both of which disclosed this polyembryony. So that I might obtain some perspective as to the probability of finding seedless heads in a normal field of wheat I contacted experts in the growing and breeding of wheat. I am consulting for a seed company (Pro Seed Inc., Blissfield Mich.) and one of my associates there is an agronomist and the other a plant breeder. First, without giving them any details I posed the question - what is the probability of randomly removing a single, normal appearing wheat head in a field and finding it completely empty of seeds ? In essence their answer was - about as likely as winning a lottery three times in a row.

There are two pertinent questions concerning the circle-polyembryony relationship. (1) What stage of plant development is critical for the formation of polyembryony ? (2) What external environmental factor can lead to polyembryony ? The first question is relatively simple to answer - the perturbation within the plant cell system most probably occurred just preceding or at the time of anthesis and fertilization of the plant. My Pro Seed associate, Mr. Duane Bell (the plant breeder) pointed out that polyembryony can occur in wheat when cross species breeding takes place - as for example, between wheat, _Triticum aestivum_ , and rye, _Secale cereale_ . In this case I assume we can be relatively confident that the farmer was not conducting breeding experiments in the circle zone.

With regard to the second question - it is interesting to note that the polyembryony type of mutation (as well as other types of genetic alterations) can be produced by ionizing radiation. As I am sure you are well aware, ionizing radiation originates from a number of energy sources (such as x-rays, electron and proton beams, cosmic rays etc.) and with a broad range of energies. With the production of secondary ionizing radiation from a high energy source, one might expect to observe other types of plant damage in addition to the polyembryony. This might occur either through radiation "burns" or other regions of reduced growth and cell damage in the somatic tissue of the plants. Very high and energetic radiation could also cause an increase in the low level background radiation within the circle regions, but, as I recall you have not definitely observed circle associated radiation.

Because of the subtle nature of the polyembryony we need to examine the possibility of a much lower energetic form of ion production. What I am thinking about here, and this is pure speculation on my part, is a form of ion plasma or ion cloud. One manifestation of high energy ion production in nature is a lightning discharge; however, I do not mean to imply that lightning is involved in the circle phenomenon. Any source that would produce a localized plasma of ions could induce subtle mutations in the meristematic or active growth centers on the plant without injuring other tissue regions. At the earth surface these plasmas or ion clouds would be very rapidly neutralized, leaving no residual evidence of their presence. In any event I feel that this type of energy production is worth considering.

<u>WHEAT HEADS CIRCLE-B</u>

Again all the glumes on the heads (3) were devoid of seeds, and although the polyembryony condition was observed, only a very small percentage of the glumes contained the bare embryos. Over 90% of the glumes were completely empty or embryo free. The difference between the degree of polyembryony formation in circles A and B is readily understood when we consider that they were 50 miles apart, the fields may not have been at the same stage of development and the circles may not have formed on the same date. Incidentally do you know their dates of formation ? The fact that both the a and B circle regions disclosed the polyembryony takes the phenomenon completely out of the realm of pure chance.

SOIL SAMPLES CIRCLES A AND B

The soil samples were removed from each bag and placed in clear plastic containers. A young, sharp eyed friend, Mr. Craig Esty noted that there were color differences between the samples. Following his observation I conducted a few "blind" tests (without the individual knowing the source of the soils). These color difference have been confirmed by everyone shown these samples (somewhere around eight individuals). The soil from controls A and B taken from outside the circles were reddish in color, whereas the soil from within circles A and B were of a more gray appearance.

About the only thing that I can think of that might possibly explain these color differences is a change in the oxidation state of the iron in the soil. That is, a change in the ferrous/ferric ratio. I am not sure what level of ionization it would take to do this, since the iron is bound up in the soil matrix. What we need here is the help of a soil chemist. Let me have your thoughts on this. I examined the samples for the formation of magnetite (a magnetic form of the high oxidation state) but did not find its presence - this was as expected since magnetite formation would have taken a tremendous energy of oxidation, one that would have produced other obvious changes. In addition the nature of the color changes suggest quite the opposite situation, that is, from and oxidized (red ferric) to a reduced (black or gray ferrous) state.

For now, that is what I have to report, and by way of comment I would like to add that it is a most enjoyable and exciting project. I am anticipating more interesting samples this summer - keep them coming. Will be looking forward to hearing from you.

Incidentally could you ask Bloomsbury Pub. to send me a quote (in U.S. $) on your circle books ? I would like to have them in my library for reference purposes.

My best regards,

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