

make my house your home; you are welcome to such fare as I have." Also Dr. G. A. Lacy, of Crocus Creek, who gave out an appointment for us to preach, furnished us a church and provided us with food and shelter as he did also to two new Elders coming out. My former companion has taken one and gone to Adair county, while Elder King, of Coyote, Garfield county, Utah, and I will travel in Cumberland county until finished, then go to Green county.

M. T. FIELD.

### ALKALI IS PLANT FOOD.

GUNNISON, Dec. 21, 1895.

Dear Sir—To my compilation of "Forty Years' Experience in Irrigation in the Arid Zone" I asked for and kindly received a supplement from J. T. Kingsbury, Ph. D., of the University of Utah; now, by permission of the author, I ask you if you kindly will give it publicity in the DESERET NEWS.

It is a scientific treatise on the fertilizing effects of alkalies, found in, and may be called native to, arid zones.

It is of particular interest to farmers within our Rocky Mountain regions, and, I think, should be made a study by progressive candidates in agricultural science in our arid zone; to give stimulus in chemical research, essential to success in this our prominent industry.

CHRISTIAN A. MADSEN.

[COPY.]

THE UNIVERSITY OF UTAH,  
Chemical and Physical department.  
SALT LAKE CITY,  
November 28th, 1895.

Bishop Christian A. Madsen, Gunnison, Utah:

Dear Sir—Your letter of inquiry has been in my hands for some time, and not yet answered. I promised to answer it, and now desire to, as far as I am able to do so. On account of being busy with school duties and chemical work, it has almost been impossible for me to find time to reply to your very interesting and important letter until today.

In regard to question 1, it may be stated that our mountain valleys are supplied with large quantities of alkalies, and therefore the soil in many instances is alkaline soil, and abundant in plant food. The meager rainfall adds to the conditions favorable to the accumulation of Alkali, and consequently mineral plant food. Silica, a principal food for wheat, must be in a condition in which it can be taken up by the plant, otherwise it is useless as a plant food. The more alkaline material there is present in the soil, the greater the quantity of silica, as a general thing, in a condition capable of being absorbed by the plants. Alkali in water increases its solvent power on silica; and in this way puts the silica in a condition whereby it is readily utilized by the plant as food. Alkaline matter promotes the disintegration of rocks, by which in part mineral food is prepared for the plant. In short, it is generally recognized, that whenever alkaline matter abounds, plant food is generally abundant, so far as mineral material is concerned. Arid

regions, too, have the necessary conditions, usually, favorable to the accumulation of alkaline mineral, while, where the magnificent alluvial deposits occur the rainfall is abundant, and washes out of the soil much of the mineral food of plants. In many instances, and especially the salts, commonly known as alkalies. It is true, however, that the soil consistent with nature, puts forth her attractive power in greater strength, for the essential ingredient of the plant, than for other mineral matter, and thus retains much more of the former than of the latter. Do not understand that all that alone is prepared for the plant in greater quantity on account of the presence of much alkali; but other wheat food, or plant food is increased for the same reason.

No. 2. Salaratus is carbonate of potassium, or bi-carbonate of potassium. The latter substance contains more carbonic acid than the former. Common saleratus generally has several substances as impurities mixed with the one given above.

No. 3. Lucern will undoubtedly accumulate nitrogen in the soil in quite large quantities on account of its long roots, supplying abundance of organic matter. Roots are among the agencies through which rocks are disintegrated. No doubt the mineral food for plants, in many instances, are prepared for the plant faster than the lucern extracts it from the soil, by reason of the abundance of roots, of which lucern is very characteristic. Of course, the food of lucern being little different in regard to the proportional amounts of its constituents, from that of other plants, as for example wheat, corn, etc., an opportunity is given, while lucern is growing and occupying the land, for the constituents of other plants to accumulate in excess of the needs of lucern.

No. 4. In the first stage of the composition of organic or vegetable matter, the humus is brown, due probably to ulmic acid and umbin; in a later stage humic acid and humin appear, when the humus is generally black. It is the water that makes it possible, for what is known as humus, to be produced. As this particular kind of organic matter is found in the presence of water and in the absence of much oxygen.

No. 5. Decaying is a slow process of oxidation, while combustion or burning is a rapid process of oxidation. The former process is not accompanied with light and much heat; the latter is accompanied with light and much heat. Both decaying and burning are a uniting of oxygen of the air chemically with the substance, decaying and burning. The products are the same, carbonic acid gas and water, the ashes remaining as the unburned or unoxidized substance.

No. 6. It is somewhat questionable to my mind, as to whether a correct observation has been made, in regard to the lucern consuming the mineral ("alkali") as fast as it comes to the surface. Lucern, according to my experience and observation, can thrive on a soil impregnated with alkali, where wheat and other plants would not grow. It is something like beets, and no doubt absorbs more of the alkalies than many other plants do, or can possibly absorb, and absorbs to certain

extent the alkali ("salaratus") in solution in the irrigation water.

No. 7. Alkali soils are "conquered" mostly by irrigation and drainage. Irrigation will only partly overcome the alkali, and does so by carrying it down into the soil, from which it will rise again, through capillary action.

The land southwest of Salt Lake City was no doubt in the most part freed from some of its alkali by irrigation, together with drainage. Lucern no doubt within more recent years has done something towards subduing these alkaline soils. Farmers have told me that they have successfully bettered the condition of some of their land in question, by raising on their land: beets, carrots and especially wild California clover. I remember one instance of a gentleman speaking to me about the use of gypsum, as a remedy for the alkali. He sowed land in the region referred to above. Whether he employed this mineral to help reclaim the alkaline soil or not I do not know. When gypsum is used for such a purpose the alkali is not gotten rid of, but only changed into a less injurious form. I might state here that the alkaline matter, or what you have called saleratus, is mostly sodium carbonate, sodium sulphate (glauber salts) sodium chloride (common salt.) Sodium carbonate mixed with organic matter or pumice, is the black alkali, sodium sulphate is the white alkali, and much less destructive to plants, of the two kinds. Now, when gypsum is mixed with the black alkali, carbonate of lime (lime stone or marble) and the white alkali are formed. The white alkali, as stated is less injurious than the black, to plants. And in clayey stiff soils carbonate of lime is very beneficial in diminishing their compactness, making them more porous and much easier to work.

No. 8. Our alkaline soils are certainly rich in the mineral food of plants, richer than the mineral soils in other regions, for the reasons already assigned, and in your own words: "these arid minerals accumulated are a blessing to agriculture." It may be also that nitrogen is converted to a certain extent, by alkali, into a form in which it can be utilized by the plant. By the presence of ozone, nitrogen and water are converted into ammonium nitrate, and hence ammonium nitrate. It is claimed that as alkali carbonate will accomplish the same thing.

There is no doubt about these arid valleys being a great storehouse of fertile soil, rich in the mineral food of plants, and that the alkaline matter is sufficiently subdued by irrigation, to give the farmer an opportunity to raise crops, which through the abundance of mineral food, makes them indeed in many instances truly luxuriant.

I should be pleased to assist you farther in your inquiries in any chemical line, as far as I shall be able to do so. And if I have not made myself clear, do not hesitate to write again.

J. T. KINGSBURY.

### PLEASANT GROVE ITEMS

PLEASANT GROVE, Dec. 26th, 1895.

—Quite a large sprinkling of our school teachers have gone to Ogden to attend the convention there.