How Burning and Other Methods of Removing Irrigated Crop Residues Affect Yields and Soils (1978)

Mark L. Hooker
George M. Herron

Follow this and additional works at: https://newprairiepress.org/kaesrr

Recommended Citation
Hooker, Mark L. and Herron, George M. (1978) "How Burning and Other Methods of Removing Irrigated Crop Residues Affect Yields and Soils (1978)," Kansas Agricultural Experiment Station Research Reports: Vol. 0: Iss. 12. https://doi.org/10.4148/2378-5977.7298

This report is brought to you for free and open access by New Prairie Press. It has been accepted for inclusion in Kansas Agricultural Experiment Station Research Reports by an authorized administrator of New Prairie Press. Copyright 1978 Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. K-State Research and Extension is an equal opportunity provider and employer.
How Burning and Other Methods of Removing Irrigated Crop Residues Affect Yields and Soils (1978)

Keywords
Keeping up with research; 36 (Feb. 1978); Kansas Agricultural Experiment Station contribution; no. 78-169-S; Burning; Crop residues; Crop yields; Soil properties; Residue removal

Creative Commons License

This work is licensed under a Creative Commons Attribution 4.0 License.
How Burning and Other Methods of Removing Irrigated Crop Residues Affect Yields and Soils.

Mark L. Hooker and George M. Herron

Burning crop residues has long been discouraged for many reasons. It pollutes the air, leaves the soil surface exposed to wind and water erosion and possibly volatilizes some nitrogen at the time of burning. Now, with crop residues proposed as a source of energy, we need to know how residue removal affects not only crop yields but also soil physical and chemical characteristics.

Several methods of managing residues have been studied for ten years at the Garden City Experiment Station. The treatments included removing the residue: 1) by burning; and 2) by physically removing as much top growth as possible; and incorporating either normal or twice normal quantities of residue. In addition, nitrogen was applied at 50 and 100 lb/A rates.

Yields did not differ significantly the first eight years of the experiment (Table 1). However, in the past three years removal and burning treatments have begun to produce lower yields than the other treatments. In 1979, yields from the two plots with residue removed were lower than from plots with residues incorporated. These results are consistent with other experiments which indicate that it may take as long as ten years to begin to observe yield reductions from burning.

*Contribution 81-504-s, Garden City Branch, Kansas Agricultural Experiment Station.
The plots were sampled to a depth of 6-feet in the fall of 1979 to evaluate the soil chemical properties under these management practices. Chemical analyses included pH, organic matter, P, K, Zn, Na, Mg, and Ca on the surface 6 inches and residual NO₃ and total N on the entire 6 foot profile. Analyses of the data showed no differences in P, Zn, Na, Mg, or Ca due to the residue management treatments. However, there were significant differences in pH, organic matter (O.M.) and potassium (K) (Table 2).

Table 1. Effect of residue treatment on yields of winter wheat.

| Residue Treatment                  | Avg.          | 1971-78 | 1979 |
|-----------------------------------|---------------|---------|------|
| Normal Residue Incorporated       | 66            | 74      |
| Physical Removal                  | 66            | 67      |
| Twice Normal Residue Incorporated | 65            | 72      |
| Burning                           | 66            | 71      |

Table 2. Soil pH, organic matter (O.M.) and potassium (K) as affected by 10 years of residue removal or incorporation.

| Residue treatments | pH | O.M. | K |
|--------------------|----|------|---|
| Normal Residue Incorporation | 7.65 | 1.8 | 1182 |
| Physical Removal | 7.70 | 1.7 | 1120 |
| Twice Normal Residue Incorporation | 7.60 | 1.9 | 1198 |
| Burning | 7.60 | 1.7 | 1100 |

Continuously removing residues (physically or by burning) decreased soil O.M. as expected because residues were not being returned to the soil. In addition, pH increased where the residue was removed. Both the pH and O.M. are very important in managing soils. Organic matter helps to maintain stability of soils by acting as a cementing agent for soil particles so granular structure of the surface soil is maintained. Organic matter also supplies some micronutrients needed for plant growth.

Soil pH affects the availability of some nutrients; as pH increases, the availability of nutrients such as P, Fe and Zn decreases. In addition, pH and O.M. are critical in some herbicide programs. The levels found after ten years' burning and removal (Table 2) are approaching these critical levels, so they may affect the rate herbicides are degraded.

Potassium is also declining where residues have been removed (Table 2). This is expected since residues are high in K. However, the concentrations observed in this experiment are still in the very high soil test category and will not limit crop production.

Nitrate-nitrogen (NO₃-N) analyses showed no statistical differences in the total quantity of this nutrient accumulated in the six-foot profile. However a higher percentage of NO₃-N has been leached deeper in the physical removal and burning treatments, (See figure below). This may reduce NO₃ availability to plants if it is leached below the zone of greatest root activity. We attribute the greater leaching to incorporating reduced quantities of residues on the two removal treatments. In these situations there is little leaching of N during residue decomposition and it remains susceptible to leaching as NO₃ during high rainfall or irrigation.

Although no immediate deleterious effects on crop yields or soil properties were observed due to residue burning or removal, the continual long-term practice of these residue management treatments will have negative effects on soil pH, O.M., K and NO₃-N. These changes may eventually have negative effects on crop yields.