

# SOIL and WATER RESOURCES

An Appraisal of the Problems and  
a Statement of Recommendations

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One of 12 committee reports prepared by representative producers in cooperation with staff members of Oregon State College and other agencies. Adopted at the statewide agricultural conference March 27-29, 1952.

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Oregon State College  
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## Foreword

A State Agricultural Conference was held at Oregon State College on March 27, 28, and 29, 1952, at which reports of 12 major committees were discussed and approved at public forum sessions. This publication contains the report of one of those 12 committees. Reports of the 12 committees are to be issued in the following publications:

|                                |                       |
|--------------------------------|-----------------------|
| Agricultural Relations .....   | Oregon Agriculture 10 |
| Dairy .....                    | Oregon Agriculture 11 |
| Farm Crops .....               | Oregon Agriculture 12 |
| Farm Forestry .....            | Oregon Agriculture 13 |
| Fur Farming .....              | Oregon Agriculture 14 |
| Horticulture .....             | Oregon Agriculture 15 |
| Land Economics .....           | Oregon Agriculture 16 |
| Livestock .....                | Oregon Agriculture 17 |
| Poultry .....                  | Oregon Agriculture 18 |
| Rural Life .....               | Oregon Agriculture 19 |
| Soil and Water Resources ..... | Oregon Agriculture 20 |
| Specialty Crops .....          | Oregon Agriculture 21 |

The purpose of this state-wide conference was to take stock of the present situation in the agriculture and rural life of the state and to indicate probable trends and desirable developments over a period of years ahead. Members of the 12 committees were private citizens who were invited by the Extension Service to participate in this activity and who willingly donated their time and paid their own expenses to take part in a series of committee meetings during the year preceding the conference. It is felt that these reports contain the considered judgment of a representative group of citizens who carefully studied available facts in arriving at the recommendations presented. They are being published by Oregon State College as a public service for use by individuals and groups who may wish to consider these facts in planning their own future activities.

Statistical data have been checked by Extension Specialists in Agricultural Economics Information and are based on the most recent available reports of the U. S. Department of Agriculture, U. S. Department of Commerce and other sources deemed reliable.

F. L. BALLARD  
Associate Director

## Summary

The future of Oregon agriculture will be based on the production from plowable crop land ranging from four million and five hundred thousand acres up to a possible five million acres. There is little chance for any further expansion in area.

This same land has supported our agriculture in the past. It has not changed materially since 1920. Any increase in production will depend upon the intensified use of this same area.

Substantial expansion in production has taken place from this limited area of crop land. Based on the same price level, the production from this land has increased by 63 per cent since 1930 while the population increased 60 per cent. This increased production was brought about through the production of crops that brought a higher return per acre, through improved cultural practices, through the application of water to land formerly dry farmed or farmed with inadequate water supply, and the increased use of commercial fertilizer.

That the demand on this land will increase seems inevitable. Reliable facts indicate a substantial future increase in population, both in Oregon and elsewhere. More people necessitate more production.

The individual farmer necessarily recognizes the increased pressure on the land. Land values have swung sharply upwards along with taxes, labor, equipment, and other costs of owning land. The individual farmer of necessity must produce a greater volume from the same acreage to stay in business.

There are ample opportunities to intensify production on Oregon's limited acreage of crop land. Much has been accomplished in the past 25 years, and there are still further opportunities to keep pace with the increasing demand in the foreseeable future.

The intensive, intelligent use of commercial fertilizer will become an established means of maintaining and increasing production of most of Oregon's crop land. Additional water to irrigate land now dry farmed or to improve supplies on land now irrigated could intensify and stabilize production on two million acres of crop land. The complete drainage of 800 thousand acres of land in western Oregon and 500 thousand acres east of the Cascades would permit the more intensive use of land, most of which is now devoted to restricted cropping due to surplus water at certain seasons. The control of floods in the Willamette Valley and in other stream basins will permit the more intensive use of substantial areas of almost productive soils.

The intensification of production will require the adoption of sound conservation farming methods in all of the different agricultural areas of the state. Neither the agricultural industry as a whole nor the individual farmer can afford to waste soil or water resources by wind or water erosion. It will be necessary to make intensive use of good crop rotations, the utilization of crop residues, and the efficient use of barnyard manure to maintain and improve the production of Oregon's most important natural resource.

# **Soil and Water Resources Committee Report**

## **1952 Agricultural Conference**

March 27, 28, and 29, Corvallis, Oregon

### **Western Oregon**

#### **DRAINAGE**

Available information indicates that Oregon has one million 300 thousand acres of land that could be improved by drainage. Of this area approximately 800 thousand acres lie west of the Cascades and the remainder is in eastern Oregon.

The value of drainage has been recognized in western Oregon since the first settlers began farming the lands of the mid-Willamette Valley. Substantial improvements have been made since that time. Throughout the state, drainage enterprises have in part reclaimed 476 thousand acres. These enterprises, mainly drainage districts, are found in all parts of the state. Much of the agricultural land in the coastal area and along the Columbia lies within drainage districts. Most of the land within these enterprises could be benefited by further intensive drainage, particularly the installation of tile or other under drains.

Census data shows that 200 thousand acres were benefited by at least partial drainage improvements between 1939 and 1949. The acreage of land completely drained is not known. Probably for the state as a whole, both within and without organized drainage enterprises, the productive capacity of one million acres could be increased from 50 to 100 per cent by further drainage improvements.

Individual farm drainage has made its greatest progress in the Willamette Valley during the past six years. All of the drain tile produced in the area has been utilized by farmers. Future drainage improvement is dependent on the development of adequate outlets in many areas which will require cooperative community action. Under the Willamette Valley Project the Corps of Engineers has completed surveys on 18 major drainage enterprises which could receive some public assistance under the flood control and drainage phase of the Willamette Valley Project. The construction of these major drains would affect 142 thousand acres and would aid in the drainage of an additional 337 thousand acres. Before work can

be started on many of these enterprises it is first necessary that the area organize into a legal subdivision. It is further necessary that Congress appropriate the necessary funds to complete the work. Financial participation on the part of those affected would be required in all cases.

An excellent start has been made on a number of community enterprises in different parts of the state under the pooling agreement provisions of the Production and Marketing Administration program. This program can encourage further development in the future.

Throughout the state individual and community drainage enterprises have been handicapped at times because of limited structures crossing established county roads and state highways and other public works. It has often been difficult to secure a crossing of adequate size and depth. It would be helpful to both the drainage and irrigation development of the state if future drainage and irrigation needs could be taken into consideration at the time that new construction is started. Adequate crossings at the proper elevation can be more economically established at that time. On the coast there are many possibilities where road fills could be utilized as dikes and tidegates could replace bridges. Farmers and drainage organizations should recognize their advanced needs and make their needs known to the proper agency during the planning stages of road and other construction.

The installation of tile and other drainage improvements usually requires a substantial investment on the part of the farmer, often beyond the reach of readily available cash. Many of the established credit agencies recognize that drainage is a permanent improvement to the land and that returns from the land will be greater by the installation of a complete system. Many farmers would be justified in assuming long-time obligations to make necessary drainage improvements.

## IRRIGATION

The major agricultural income in Josephine and Jackson Counties is dependent upon irrigation. In the remainder of western Oregon irrigation has developed to major importance in the past 25 years. Twenty-five years ago less than three thousand acres were irrigated in the Willamette Valley. Today about 100 thousand acres are irrigated. The increase has been in similar proportions in Douglas and in all of the coast counties. Development has reached the point throughout western Oregon where further progress

is dependent on increased water supplies with the exception of only a few coastal streams.

### **Water available under Willamette Valley Project**

Two hundred thousand acre feet of water is now available from storage in the Long Tom, Dorena, and Cottage Grove reservoirs. This will be increased to 750 thousand acre feet when the Detroit and Lookout Point Dams are completed. This water will be released during the summer months for irrigation, navigation and other purposes.

Water available for irrigation from Lookout Point, Detroit and other dams built subsequently will be under the control of the Bureau of Reclamation. Probably the water from Fern Ridge, Cottage Grove, and Dorena will come under its control. The Bureau has detailed or preliminary plans for projects to distribute this and other stored water in many sections of the Valley. Its plans indicate that water can be distributed to 520,970 acres from projects now under construction. Water will be made available by the Bureau of Reclamation under two separate plans. Under the plan generally used in the West the Bureau builds up the project including the distribution system and farmers benefited under an irrigation district contract to repay the construction cost and assume the cost of distribution.

Under an alternative plan the Bureau would construct and operate the distribution system and sell the water to individuals at some stated rate per acre or per acre foot. The Bureau would continue to own and operate the system. The latter plan has general preference in the Willamette Valley although, with the continued general increase in demand for water, the first plan is likewise workable.

Regardless of construction by the Bureau of Reclamation or other agencies, substantial irrigation expansion is dependent upon some type of community development, either through irrigation districts or similar organizations, cooperatives or private companies. All have been successful in this area.

### **Ground water supplies**

Further irrigation expansion is possible through the utilization of ground water supplies, though the extent of this development is not known. In certain areas, particularly near Eugene and in northern Marion County, competition between irrigation wells results in limited supplies during the late part of any irrigation season.

To determine the extent of possible ground water supplies the Committee feels that extensive detailed ground water study should be

made by the United States Geodetic Survey in the Willamette Valley to supplement the work completed in 1928 and 1929. Further studies should be completed in the Rogue River Valley.

To provide for the full utilization of ground water supplies and to prevent overutilization which could result in serious financial losses to many individuals and others, the Committee feels that the use of ground water for irrigation, industrial and municipal purposes should come under the administration of the state engineer as it is in eastern Oregon. Legislation should be developed only after careful study to insure that such an administration will result in full beneficial use.

### **Small reservoirs**

During the past few years a number of farmers in western Oregon have constructed dams to store water to supply their own irrigation needs. Many more storage possibilities are available and definitely should be developed. Individuals should construct such reservoirs only with adequate engineering assistance to be assured that the project is economically feasible and that sound principles of construction are followed.

Many of the better small reservoir sites could best be developed by the cooperative efforts of several farmers. Often such cooperative projects would provide more water with less cost than with individual development.

Incentive payments under the P.M.A. program have stimulated the construction of small storage reservoirs. The Committee believes that such incentive payments should be continued and that the expenditure of public funds to provide more stored water benefits the general public as well as the individual.

Long-term financing from public and private agencies would aid in the development of storage reservoirs that should be eligible for long-term financing since they are a permanent improvement.

### **Rogue River Basin**

Additional water is a major need for the continued agricultural development of the Rogue River Basin. This area in Josephine and Jackson Counties now has 64,000 acres classed as irrigated land. Of this area 63 per cent or 40,300 acres has an inadequate water supply. Seventy-three thousand five hundred acres are suitable for irrigation but are not now irrigated. Of this area 47,000 acres are dry farmed and 26,100 acres of new land could be developed.

Adequate water supplies for existing projects and for the reclamation of the 73,000 acres could be made available for irrigation farming under Plan A as proposed by the Bureau of



Reclamation. The adoption of this plan has been temporarily delayed because of objections from sportsmen and other interests.

Because of these objections the Bureau has proposed an alternative plan which would include the construction of the Howard Prairie Reservoir. This would provide irrigation for 5,000 additional acres for the Talent District and 1,800 acres for the Medford District and supply adequate water for the lands now irrigated within these districts. In addition, facilities would be provided for the irrigation of 17,200 acres of new land in the Illinois Valley and provide adequate water for 7,400 acres of land now having only a partial supply.

### **Experimental work needed**

The intensive development of irrigation in the Willamette Valley will require the development of cropping systems to make full utilization of water possible on the irrigated farm. There is a definite need for the development of new crops that would profitably fit into a crop rotation with other crops now being irrigated. There is also room for immediate intensive work on the best types of management for irrigated crops including the duty of water as well as work on the proper methods of water application.

The development of irrigation in western Oregon would be aided by adequate technical assistance to help the individual farmer and groups of farmers develop the necessary individual farm and community irrigation projects and to aid in developing the irrigation cropping system following the availability of irrigation water.

### **FLOOD CONTROL**

Recurring floods in the Willamette River bottom have prevented the full utilization of 200 thousand acres of rich river bottom soils. Because of the frequency of floods the growing of many intensive crops has not been possible in this area though the soils are the best adapted to intensive production of any in this area. Even with floods as a recognized hazard the annual damage to agricultural production has been substantial both in loss of crops and improvements, and in actual loss of soil.

According to records available from the Corps of Engineers the greatest known flood covered an area of 500 thousand acres. The more recent floods of 1943 and 1945 covered 350 thousand acres.

Flood control is a major objective of the Willamette Valley Project. With the completion of the entire project flood water will no longer endanger agriculture in the immediate Willamette River

bottom nor on some of the major tributaries. The flood control benefits from dams now constructed average \$1,000,000 annually. With the completion of the Detroit Dam in 1953 this annual benefit will be increased to \$9,000,000.

There are many streams in the Willamette Basin not affected by present planned improvements under the Willamette Valley Project that suffer severe annual losses from winter floods. There are flood control problems on most of the major streams in the coastal area and in both the Umpqua and Rogue Basins.

### SOIL EROSION

Because of the nature of the rainfall throughout most of western Oregon, soil losses do not usually occur as spectacular catastrophies. Yet, on sloping land, the loss of soil has been serious to the point of impairing agricultural production in substantial areas.

Fortunately the profitable seed producing industry has replaced the soil-depleting grain or row crops formerly produced on much of this erosive land. These seed crops, including both grasses and legumes, have not only controlled erosion but have rebuilt the organic matter and soil fertility on many of the poorer soils in the Valley.

Serious erosion problems continue to exist on those farms producing annual crops on the fruit and nut orchards and on both hill and overflow river bottom soils. Substantial progress has been made in controlling erosion by the use of cover crops in these orchards. Still under the best management cover crops do not provide complete control. This is particularly true of walnuts and filberts where the time of harvest necessitates delays in seeding.

The more serious immediate erosion problem exists in those areas chiefly in the north end of the Valley where strawberries, cane fruits, annual vegetables and nursery stock are grown on steep lands. Soil losses here are severe and known methods of control are often not practical. For this area the Committee recommends that more intensive use be made of contour planting, terraces, and other erosion control measures and that every effort be made to shift as much of this production as possible to the fertile Willamette Valley as these lands become protected under the Willamette Valley Project.

Throughout the hill lands of the Willamette Valley much wider use should be made of strip cropping, contour farming and diversion terraces. The Committee also feels that studies should be launched to determine crops that could be profitably grown to replace or rotate with seed crops that would provide the same soil protection.

## SOIL FERTILITY

Because of the continued increasing demand for production from western Oregon farm lands farmers will be tempted to concentrate on those crops bringing in a high return per acre, many of them cultivated crops. This intensive production will require special attention to soil management. This intensive agriculture should not be adopted without adequate provision for maintaining the supply of organic matter by the intensive use of cover crops and crop rotations.

## RECOMMENDATIONS

1. Steps should be taken to modify existing legislation to provide a legal means of distributing costs, for obtaining necessary rights of way construction, and to provide continued adequate maintenance of community drainage enterprises.
2. Drainage developments in the Willamette Valley should be completed in accordance with over-all plans for drainage projects prepared by the Corps of Engineers. By following these plans partial improvements can be made that will efficiently fit into the plan covering the entire area.
3. To facilitate both drainage and irrigation developments and to protect our present and future needs for maintaining our better lands in production, closer cooperation should be developed between the agriculture interests, county courts, the State Highway Commission, and other agencies in charge of public works to insure the installation of adequate drainage outlets, irrigation crossings, and similar structures for present and future needs at the time these public works are located. In the coastal area substantial economies could be effected for drainage improvement by the utilization of highway and road fills as dikes and the installation of tidegates instead of bridges. Interested farmers should make their needs known to the public agencies in advance of construction.
4. Drainage under the Agricultural Conservation Program has in the past contributed to substantial and permanent drainage improvements on the individual farm and on community projects. This assistance could well be continued in the future.
5. Immediate steps should be taken by the Bureau of Reclamation to construct a project in the Willamette Valley to distribute water for irrigation from stored water available in established reservoirs. In the beginning the water should be delivered to the farm on the rental basis.

6. Farmers in areas needing additional water should take immediate steps to develop community organizations to construct their own distribution facilities or to cooperate with the Bureau of Reclamation or other agencies.
7. Immediate steps should be taken to enact legislation to provide for the full utilization of ground water resources in western Oregon and to protect those who have now and will in the future make substantial investments to effect the utilization of ground water.
8. The Experiment Station should launch immediate experimental work to develop new crops that can profitably be grown under irrigation in the Willamette Valley, to develop better management practices of crops grown under irrigation, and to provide further information on the better application and use of water.
9. The Bureau of Reclamation should start immediate construction on the Howard Prairie Reservoir and on the project to provide additional water in the Illinois Valley as a part of the logical development of the Rogue River Basin. The Committee strongly supports the development of the entire Basin under Plan A as proposed by the Bureau of Reclamation. This immediate development would become a part of this plan.
10. As a means of bringing about the solution to a major soil erosion problem in the Valley we request the cooperation of both public and private agencies to bring about a shift in the production of many intensely cultivated crops from the erosive hill lands to the better adapted river bottom soils. These river bottom soils will be available for intensive use with the control of floods under the Willamette Valley Project.
11. Because of the importance of flood control, irrigation, and drainage to a sound program of agricultural development in Oregon we urge the immediate completion of the Willamette Valley Project in its entirety.
12. Flood control studies should be authorized and completed immediately by the Corps of Engineers on tributary streams in the Willamette Valley and on coastal streams.
13. The Corps of Engineers and Bureau of Reclamation should be authorized to take immediate steps to provide water storage and other facilities to provide additional water supplies, control floods, and improve drainage in the Tualatin Basin.

## Eastern Oregon

Approximately one-fourth, or one million 300 thousand acres, of Oregon's crop land is irrigated, according to the 1950 census. All but 100 thousand acres of this irrigated land is found in eastern or southern Oregon where irrigation water is necessary for sound farming operations. During the past 10 years, more than one-quarter million acres were brought under irrigation. Major developments occurred in Klamath, Malheur, and Jefferson Counties under projects constructed by the Bureau of Reclamation.

### Water supplies limited

While the area reported as irrigated was substantial, less than 500 thousand acres has an adequate water supply to permit the growing of any crop adapted to climatic conditions. Production is limited by water shortage in some areas every season, while in other areas the shortage is periodic. Some of the land now irrigated has only flood water available early in the season.

Further expansion of irrigated land is dependent on increased water supplies. These additional supplies can be made available by water storage supplemented by an unknown quantity of ground water. Most of the low-cost water storage projects have already been completed by private enterprises, irrigation districts, or by the Bureau of Reclamation. Only the more costly projects remain, but because of increased demand for both land and water it is apparent that higher costs are justifiable both now and in the future. As a matter of principle, the Committee believes the general public should share in the cost of water development. Farmers on irrigation projects, who in the past have assumed the financial responsibility, represent only one segment of our economy benefiting from these developments.

### More storage needed

To keep pace with increased demand for agricultural production, the Committee believes that projects now under consideration by the Bureau of Reclamation should be constructed immediately. Planning work should be completed to permit development of future projects as the demand increases. A survey should be made to determine the possibility of utilizing all available water sources for irrigation including reappraisal of former projects abandoned on grounds that they were not economical.

### **Small community and individual projects**

There is an opportunity for increasing water supplies through construction of small storage reservoirs by individuals or by small community enterprises. There are also many opportunities for improving water supplies by the construction or reconstruction of community distribution systems.

These smaller developments by individuals or groups of individuals are handicapped because of the lack of facilities for adequate financing. At various times in the past funds have been available for projects of this type through the Case-Wheeler or the Water Facilities Program administered by the Department of Agriculture. It would be only fair that these smaller projects be extended the same benefits that are extended to farmers on larger projects, at least to the extent of long-time low-cost financing.

The increased demand for irrigation water is also reflected through the increased number of wells being drilled. Some individuals have secured adequate supplies while others have wasted substantial sums of money because of the lack of adequate information on availability or possible extent of ground water.

### **Production from wild meadows can be increased**

A substantial portion of the irrigated land, perhaps as much as 500 thousand acres, is devoted primarily to the production of forage to support the livestock industry. Much of this area is in natural wild meadow and is dependent on direct supply of water from streams. Only a limited amount of this land has a full season water supply. The general practice is to permit water on the meadows until time to harvest hay. Because of natural drainage restrictions or because of the existing irrigation practice, much of this land is poorly drained. Experience has shown that production from this land can be doubled and often trebled through an improvement program which involves drainage, controlled irrigation, proper seeding, and use of commercial fertilizer. The first step in the improvement of wild meadow land is to convince operators that the improvements will pay. This can be accomplished by the establishment of demonstrations and a sound educational program. Qualified technical assistance will be needed to plan the necessary irrigation and drainage improvements.

### **Alkali problems on irrigated land**

In addition to the wild meadow land affected by poor drainage, nearly 200 thousand acres under established irrigation projects have drainage problems of varying severity. Probably 100 thousand acres have become practically worthless because of the accumulated alkali

salts and a substantial acreage is being threatened. In the past few years some progress has been made toward the utilization and improvement of these alkali lands. Further studies should be made to bring about the economical improvement of these lands and to develop additional crops that can be profitably grown under alkaline conditions.

### **Community drainage projects**

Improvement of drainage on irrigated lands in many cases requires community or district cooperation to provide and maintain outlets. This often requires the organization of a drainage district within an irrigation district to provide the necessary improvement. In future projects it would be helpful if plans for drainage improvement were included within the original organization. This organization should have the power to condemn rights of way and to equitably collect funds for construction and maintenance of drainage ditches.

### **Good farming is essential to permanent agriculture**

Agricultural areas having a full season's water supply have distinct advantages for producing intensive crops. During the past 10 years the demand for potatoes, sugar beets, onions, and other row crops has caused a general increase in the cultivated acreage on irrigated projects. In some areas this intensification has proceeded to the point where the soil organic matter is becoming so depleted that the land is in danger of becoming permanently damaged. Under any intensive cropping program provision should be made for continued organic matter renewal either through sound crop rotations or a green manure and cover crop program.

### **Improved water use possible**

The need for increased water supplies will be aggravated by the intensification of production on irrigated lands. The heavy use of commercial fertilizers, improved varieties, and improved cultural practices have greatly increased yields and will increase them further. Obviously, higher yields require more water.

On any irrigation project the water available for crop production could be increased from 30 to 50 per cent by the improvement of irrigation practices on the farm. Farmers in irrigated areas have made substantial progress toward improved water use the past five years but the work is only well started. Benefit payments under the P.M.A. program have been particularly helpful through payments made available for leveling land and for reorganizing farm irrigation systems. This program could well be continued though it should be guided by adequate technical assistance.

In some areas in Oregon the switch to sprinkler irrigation has brought about the better use of water and practically eliminated soil erosion. This change has been extensive in the Hood River Valley and many of the steep orchard lands near The Dalles which were formerly dry-farmed, and are now sprinkled. There are other areas where sprinklers could well replace other forms of irrigation to bring about savings in both soil and water.

### RECOMMENDATIONS

1. The Bureau of Reclamation should start the construction of the Crooked River, Baker Valley and Benham Falls projects in the immediate future. Planning work should be intensified on other projects to permit early construction as the demand for water increases.
2. The Committee believes that the general public should stand a portion of the cost of the development of irrigation projects because the benefits from the production of new wealth on these projects are not limited to the individual farm—they extend to every segment of the population.
3. Comprehensive surveys should be completed by the Bureau of Reclamation or other agencies to determine the full extent of possible irrigation expansion in the state.
4. Substantial improvements in water supply could be brought about by the construction of small water storage and water distribution projects either by individuals or by small groups. Rules governing the operation of the Bureau of Reclamation should be modified to permit the construction of the larger of these projects. Adequate financing for the smaller projects should be made available through the Water Facilities program of the Farm Home Administration.
5. The improvement of production from wild meadow hayland can be an immediate contribution to Oregon's agricultural production. The Committee urges that all interested agencies, including the Extension Service, P.M.A., Soil Conservation Service, and farm organizations, launch and organize educational and demonstrational programs to bring about immediate improvement of these lands.
6. Irrigation and drainage laws should be amended if necessary to permit the construction of community drainage enterprises by the same organizations holding the responsibility for the distribution of irrigation water.



7. Assistance for improved irrigation practices should be continued under the P.M.A. program.
8. Farmers on irrigated land should follow a sound program of farming that provides for adequate maintenance of soil productivity through the use of proper crop rotations, green manures and other soil building measures.
9. The procedure to secure a permit for right-of-entry on public lands to develop, impound and control water should be simplified.
10. Stream control should be a community project with power to plan, construct, and maintain improvements. The recently enacted Water Control District Law with modifications could be applied to a stream basin to prevent misuse of land along stream banks that might result in substantial damage to adjacent areas.

### **Columbia Basin**

Forty per cent, or two million acres, of Oregon's cultivated land are devoted primarily to the production of wheat under the summer fallow system of farming. Most of this land lies in the basin immediately adjacent to the Columbia River, though a portion extends into Baker and Union Counties. Rainfall is generally limited, ranging from 10 inches to 20 inches annually in different localities. Much of the area is made up of steep, rolling lands.

Erosion control is recognized as a major problem. This area has a reputation of being one of the nation's critical erosion areas. Erosion is serious because of the steep topography and because the bulk of the precipitation occurs during winter months when cover is at a minimum. Much of the precipitation is in the form of snow on frozen ground which further aggravates run-off and moisture penetration problems.

The summer fallow system of farming has been developed to provide the necessary moisture and plant food to produce a profitable crop. This fallow system in itself severely aggravates the erosion problem in that natural cover is completely removed during the fallow season.

#### **Straw and stubble are controlling erosion**

During the past 10 years, substantial progress has been made toward the adoption of practices that reduce annual soil loss. One major change that has proved helpful has been a reduction in the number of cultivations. Cultivation conserves moisture only

by the control of weeds. Additional cultivation tends to reduce moisture penetration and makes the land more susceptible to erosion. The use of straw and stubble for erosion control is becoming quite widely adopted and contributes more than any single practice to the reduction of soil loss. The use of nitrogen fertilizer has been a distinct aid during the past four years. The acreage receiving nitrogen has increased from a few hundred up to 200 thousand. With the widespread use of nitrogen, practically all straw and stubble are utilized for erosion control and soil building, where a few years ago substantial acreages were burned. Nitrogen has been a distinct aid in securing good stands of wheat which proves an effective measure in controlling erosion.

The use of nitrogen fertilizer under the proper conditions has proved to be a highly profitable practice in the Columbia Basin area. In 1951 the production of an additional two million bushels of wheat could be largely attributed to the use of nitrogen. There is a definite need for better information on rates of application for varying soil and moisture conditions. It is quite probable that soil analyses to determine moisture and available nitrogen could be used as a basis for directly determining the amount of fertilizer to use. Because of the recognition that the service can be helpful and profitable to the farmer the Pendleton Grain Growers Incorporated at Pendleton are launching a commercial soil testing service this season. There is a demand for similar services in other areas.

Columbia Basin farmers have been slow to adopt other conservation measures, but not without ample justification. Strip cropping, contour farming, diversions, terraces, and sodded waterways are difficult to apply, but their value in reducing erosion is recognized. The equipment for cultivating, seeding, and harvesting now available on Columbia Basin farms is not adapted to farming under these conservation practices.

### **Crop rotations**

A possible long-time rotation with wheat and perennial grass has been suggested as a means of reducing erosion and maintaining soil fertility. Erosion is eliminated while the area is devoted to grass and is substantially reduced for several years after the grass is plowed because of the improved soil structures. Under actual practice where stands of grass have been plowed and re-cropped to wheat, the yields as reported by farmers are conflicting. Studies at the Moro Branch Experiment Station indicate no significant increase in yield over comparable areas devoted to continuous summer fallow wheat system. Further studies are needed before long-time grass rotations can be recommended in areas of light rainfall.

The use of sweet clover as a green manure with or without utilization by livestock has been a successful means for maintaining soil fertility and reducing soil erosion in parts of the Columbia Basin lying in Washington and Idaho. This practice is being given extensive trials in many parts of Oregon's Columbia Basin. Green manure crops can be used effectively in areas having 16 inches or more rainfall. In these areas grasses for seed and grasses and legumes for livestock feed offer profitable rotation possibilities.

### **Continuous cropping a future possibility**

Experiment work at the Pendleton Field Station as well as in Washington and Idaho indicates that continuous cropping in some parts of the Columbia Basin is definitely feasible. Summer fallow is now practiced for two purposes: (1) to save moisture from two seasons to produce one crop, and (2) to accumulate available nitrogen in the soil.

In parts of the Columbia Basin effective soil depths are filled with moisture completely each season. Here it would appear that the addition of nitrogen in adequate amounts would eliminate the necessity for fallow. Erosion would be reduced by providing continuous cover of either a growing crop or stubble. Limited experience by farmers in Oregon indicates this system is both feasible and profitable. Further information is needed on cultural practices such as time for plowing, seeding, crop varieties, and weed control. There is immediate need for information on rates, time, and method of application of fertilizers.

### **Combination of practices necessary for erosion control**

Farmers in the Columbia Basin should recognize that no single erosion measure will completely stop soil losses in the area or on any individual farm. Full use should be made of straw and stubble, rough tillage, diversion of problem areas to grass, sodded waterways, strip cropping, terraces and diversions, and other practices in such combination that best fit the needs of each individual field.

### **Blow soils should not be farmed**

During the past five years, because of favorable moisture and high prices for wheat, substantial acreages of land formerly idle have been put in crop. Much of this acreage is in areas where severe erosion has taken place in the past and will again in the future. These lands are so located that erosion not only damages the acreage farmed but also endangers adjoining agricultural land. Steps should be taken to prevent erosion from starting on the lands now broken up and to prevent the further expansion of farming in these hazardous areas.

**Rain control**

There is substantial interest all over the state in the various means of cloud seeding to control precipitation. It is recognized that if these operations could substantially increase the natural precipitation, agriculture all over the state could be substantially benefited.

Interest in cloud seeding operations is particularly intense in the Columbia Basin area. Farmers in this area have \$70,000 invested in the cloud seeding operations for the 1951-52 season. The success of operations conducted the previous season is problematical. Studies carried on by the Experiment Station in cooperation with the Oregon Wheat Commission indicated no definite benefits. The Committee believes that controlled studies of rain making operations should be conducted and that any such operations conducted by any agency be so planned that full evaluation of the different operations is feasible.

**RECOMMENDATIONS**

1. The cooperative educational program on soil conservation in the Columbia Basin area with the Extension Service, P.M.A., soil conservation districts, Soil Conservation Service, Oregon Wheat Growers League, and other agencies should be continued and intensified.
2. The research work on soil conservation now being conducted by the Soil Conservation Service in cooperation with the Pendleton Branch Experiment Station should be continued. Farm machinery manufacturers should avail themselves of information available from this work and from other sources to develop and make available farm machinery that will adapt to the many different erosion control practices.
3. The Experiment Station should establish cooperative field plots to determine proper rates and methods of using commercial fertilizers in the Columbia Basin as suggested for other areas. In addition, this work should include controlled experiments on the use of sweet clover or other legumes as another means of obtaining the necessary nitrogen.
4. Studies should be continued by the Soil Conservation Service and other agencies to develop the proper technique for establishing strip cropping, diversion terraces, and other erosion control measures to Columbia Basin conditions.
5. Assistance under the P.M.A. program for the establishment of conservation practices should be continued but substantially

- greater portions of the funds should be used to establish permanent rather than annual soil conservation practices.
6. Field studies should be completed immediately by the Department of Agricultural Economics, Oregon State College, to determine the cost and returns involved in the different soil conservation practices.
  7. The Experiment Station should, in cooperation with other agencies, continue studies to determine the present and future value of cloud seeding operations. Contracts with agencies engaging in cloud seeding operations should be so drawn to require the furnishing of all data to the Experiment Station and other agencies to insure proper evaluation. Hampering legislation should be withheld to allow sufficient experimental work.

## General

Because of the wide diversity of climatic and soil conditions in Oregon the Committee has considered soil and water problems in three geographic divisions: western Oregon, eastern Oregon irrigated land, and the Columbia Basin dry farm area. Commercial fertilizers were considered for the state as a whole because of the general application to each area. The discussion among the committee members in the different areas developed several points that have state-wide application.

Any sound program of soil and water conservation should be based on the accurate knowledge of local conditions. Changes in land use on the individual farm or in substantial areas should be based on a sound knowledge of the soil capabilities and limitations. Adequate published soil survey information is available for only a portion of the state. The completion of this important soil inventory is basic to a sound conservation program.

In all parts of the state there is an intensified demand for more water both for irrigation and for livestock and domestic purposes. Little accurate information is available on the ground water supplies in the different areas. With accurate information available further supplies could undoubtedly be developed; also, farmers might be spared the sizeable expenditure of money on drilling wells in areas where no ground water exists.

It is apparent that substantial multiple purpose water development projects will be constructed in Oregon and in adjoining states in the immediate future. Much of Oregon agriculture has been developed through the use of water for irrigation. Future expansion

and development is dependent on the use of more water. Under the state administration of water rights established by the water code in 1909, the prior rights of irrigation have been recognized and established. The Committee is fearful that these rights might be jeopardized should the control of water rights be changed in any way. The prior rights of land now irrigated should be recognized. Further, water supplies should be set aside to provide for future irrigation expansion.

Oregon law provides for the organization of soil conservation districts for the purpose of bringing about the adoption of soil conservation measures. Under this law 36 districts comprising 14 million acres have been organized in the state. These districts have been an aid in bringing about substantial improvements in land and water use. They have provided a means for cooperative action to solve common problems. The work in these districts has been substantially effective because of technical service extended by the Soil Conservation Service of the United States Department of Agriculture. Farmers all over the state should become acquainted with the possibilities of soil conservation district organization and consideration should be given to the organization of additional districts where such organization can result in improved land and water use.

From time to time in the past, production controls have been enforced on different crops to bring about improved marketing conditions. On the individual farm these controls usually mean a reduction in the acreage of that crop over the acreage normally produced. Should such production controls be inaugurated in the future, plans should be made both by the agency in charge of administration and by individual farmers to take full advantage of any acreage diversions to effect soil building practices.

### RECOMMENDATIONS

1. A soil survey of Oregon's farm and range land should be completed as soon as possible. The completion of this soil inventory could be expedited by better cooperation between agencies now working in the field including the Experiment Station, Bureau of Plant Industry, Soil Conservation Service and the Bureau of Reclamation. Data obtained for a modern four-factor survey showing (1) soil type, (2) slope, (3) degree of erosion and (4) land use once obtained should be useful for all agencies and to individual farmers. These agencies should develop a common program of mapping

- technique and any information obtained from each agency should be assembled to permit the early publishing of reports for general use.
2. Soil survey reports completed in the past by the Experiment Station and the Bureau of Chemistry and Soils are no longer available for many counties. The Committee recommends that these reports be re-published where the supply is exhausted.
  3. When multiple purpose water development projects are inaugurated in Oregon or in adjoining states, full recognition should be given to existing water rights for irrigation and provisions should be made to preserve adequate supplies for future irrigation developments. These rights should be established as being prior to all except water for livestock, domestic purposes, or municipal use. The administration of water rights should be retained by the state.
  4. Should production controls be inaugurated in the future, plans should be made by both the agency in charge of administration and by individual farmers to take full advantage of any acreage diversion to effect soil building practices.
  5. The farm unit, under average management for the type of farming involved, should yield sufficient income to provide an adequate standard of living for the farm family. The farm unit should be of sufficient size and the operator should have adequate capital and equipment to permit proper use and conservation of the land.
  6. Rental agreements should be so drawn to encourage continued use of good conservation practices.
  7. Future road and highway construction should be so located to give protection to the long-time production of agricultural lands.
  8. Logging operators should be compelled to protect the soil and prevent erosion following a logging operation by reseedling. Check dams should be constructed and water spreading practices established where applicable.

## Commercial Fertilizers

The increased use of commercial fertilizers will play an increasingly important part in maintaining or increasing the production of Oregon's five million acres of crop land. In the past 10 years the usage has increased from 25 thousand tons to an excess of 108

thousand tons. Estimates indicate that the use will increase by an additional 50 per cent within the next five years providing adequate supplies are available.

### **Fertilizer costs important money**

The expenditure for fertilizer is a major item of expense on many farms that now totals in the neighborhood of eight million dollars annually for the state as a whole and will jump to twelve million dollars in a relatively short time. Though this is a substantial expense it actually means increased returns to the farmer since it is quite probable that each dollar spent for fertilizer will bring back \$4 to \$5 or more in increased production. The proper intensive use of fertilizer on Oregon farms could increase production on the present cultivated acreage by 25 per cent and return a profit to the farmer.

Fertilizer is important not only from the standpoint of increasing production but also as an aid to the use of sound soil conservation measures. Fertilizers make possible the efficient use of crop residues for erosion control and soil building. They are necessary for the effective growth of permanent cover crops and annual cover crops, and in orchards and other cultivated land. With the heavy use of fertilizer the production of grass for feed will become both a perfect conservation practice and a highly profitable crop.

### **Heavy cropping takes plant food**

There are several reasons for the increased use of commercial fertilizers. Much of Oregon's farm land has been farmed for 50 years, some for 100 years. The use of commercial fertilizers is a necessity to replenish and maintain the supply of mineral plant food removed both by crops and by erosion and leaching. The increased use here is a duplication of experience in all older agriculture areas.

Increased knowledge in the effect of commercial materials on crops is likewise a major factor in increased use. Farmers have found that the proper use of right materials can be profitable even on near virgin soils.

### **Fertilizer supplies**

Oregon is so situated that it will necessarily be an importing state for fertilizers carrying nitrogen, potash and probably phosphorus for many years to come. Neither raw nor byproduct materials are available in sufficient quantities to justify the establishment of manufacturing plants. Oregon has had difficulty in maintaining fertilizer supplies for the past 10 years because it is an



importing state. The same disadvantage will continue in the future. Since 1942 supplies of fertilizer materials, particularly those carrying nitrogen, available to farmers in Oregon have not been equal to the demand. This same situation will continue for the next five years and probably longer.

The apparent short supply is caused by the sharply increased demand for fertilizers all over the United States. This demand will continue to expand at the same rate as indicated for Oregon, especially in those states west of the Mississippi.

Because of the competitive demand for fertilizer materials and because Oregon is an importing state it will be necessary to give special attention to maintaining adequate supplies. Fertilizer factories must be large-scale enterprises producing substantial tonnages under continuous operation. To permit continuous operation a continuous flow of material must be maintained from the factory. For economical operation this flow should be constant regardless of seasonal demand. Oregon farmers have been able to maintain nearly adequate supplies by purchasing substantial portions of the annual needs during periods of off-season demand. It is quite probable that the need for this advance purchase will continue in the future.

As the fertilizer marketing situation exists now in Oregon, the small farm operator with a limited operation budget is distinctly handicapped in the purchase and use of fertilizer, because he is not in a position to finance advanced purchases nor furnish adequate farm storage facilities. The specialized grower who produces specified crops for processors or marketing agencies is often protected by these agencies. No such protection is now available to the general farmers and livestock operators.

Farm storage of fertilizers has some serious disadvantages.

- It necessitates tying up sizeable amounts of capital over a period of 2 cropping seasons.
- The farmer usually takes some losses through wasted material and loss of conditions.
- Fluctuating prices too often result in a higher cost of fertilizer.
- Labor operations may be seriously disrupted to permit accepting delivery at an unspecified time.

### **Mixed fertilizers**

At the present time the main fertilizer usage in Oregon is made up of "simples," materials carrying only nitrogen, phosphorus, or potash and ammonium phosphates, materials coming from the factory and carrying both nitrogen and phosphorus. There is a sub-

stantial demand for complete materials, those carrying nitrogen, phosphorus and potash, particularly for use on cultivated crops. It is anticipated that the use of these completes will increase in relation to the tonnage of simples used. This increased use will be necessary to replace deficiencies in two or more plant foods.

At the present time the major share of mixed materials used in Oregon are prepared at plants in Portland or Seattle. This makes it necessary to ship simple materials to these points, then reship the mixed goods with additional local freight to the point of use. There is a possibility for savings in transportation cost by the decentralization of mixing facilities to avoid the payment of extra transportation costs. This possible advantage is in part offset by the fact that the major mixing plants can make use of lower cost materials, particularly anhydrous ammonia and nitrogen solutions.

### **Anhydrous ammonia**

In the past three years the use of anhydrous ammonia as a direct application has become an important source of nitrogen in the Columbia Basin counties and in Klamath County. Its use could be extended to the irrigated areas of eastern Oregon and to the Willamette Valley as an addition to the apparently short nitrogen supply.

### **Agricultural lime**

Studies completed by the Experiment Station indicated that in the Willamette Valley and on the Coast there are over 900 thousand acres of land badly in need of lime as a major initial step in developing a good program of soil management. These studies further show that the loss of lime by leaching and by crop removal totals 180 thousand tons annually. This need has been recognized by farmers and by public agencies for the past 40 years and efforts have been made to remedy the situation. At first, state aid was involved through the processing of agricultural lime at the state penitentiary. This aid continues but the tonnage produced is minor. Later, in the early 40's, benefit payments for the use of lime became available under the Agricultural Conservation Program of the Production and Marketing Administration. The tonnage used was disappointing until 1945. At that time practical methods of bulk handling were set up whereby lime could be taken directly from the source or from freight cars by truck. These same trucks would then spread the lime on the land at the desired rate. Bulk handling eliminated the cost of bags and reduced other handling and spreading cost. In the past few years the use of lime has ranged between

60 and 80 thousand tons annually—still more than 100 thousand tons shy of the annual need.

### **Heavy fertilizer application increases lime need**

The increasing intensive use of commercial fertilizer is aggravating the need for lime. Heavy lime applications are often necessary to make the use of commercial fertilizers effective. Furthermore, most of the nitrogen-carrying fertilizers used in Oregon leave an acid residue and aggravate the need for lime. Because of problems of supply these same materials will be used in the future. On many soils the continued heavy use of fertilizers has increased the need for lime as much as two tons per acre.

### **Supply of agricultural lime inadequate**

Unfortunately, there are only limited supplies of lime rock available in or near the areas of major need. Adequate natural supplies are available only from southern Oregon, eastern Oregon or Washington. In the past few years the supply of lime rock available for distribution has never reached the demand. Despite the fact that the demand has exceeded the supply, few primary producers of agricultural lime have been able to maintain production. There have been only two sources that have remained in the business for a period of more than five years under the same management. Neither can meet the entire demand.

In the past any number of individuals and companies who have started in the lime production business have suffered substantial losses. This could lead to only one conclusion—the return to the producer has been too low. If supplies are to be increased to meet the annual need of 180 to 200 thousand tons annually the farmer may necessarily pay more for the material. Actually at the present average cost of \$10 per ton delivered and spread on the farm, the cost of lime has not increased greatly over the cost in the early 30's.

In the past ten years the use of lime has received substantial encouragement through the Agricultural Conservation Program of the Production and Marketing Administration. The benefit payments roughly equal one-half of the cost. Committee members felt that if this program should be terminated that in some areas, particularly on the Coast, use would drop 50 per cent.

### **More fertilizer research needed**

The Committee recognizes that the substantial tonnage of fertilizer used on Oregon farms is necessary to maintain and intensify production and that the substantial annual investment by farmers in fertilizers is generally highly profitable. On the other hand it

is likewise recognized that maximum benefits from the use of fertilizer are seldom achieved. Few farm operators have adequate information on types of materials to use, the best rates, the best methods of use, or the best time of use. Lack of such knowledge results in substantial losses in the form of wasted or misused materials and, of greater importance, the loss in return brought about by the use of inadequate amounts.

The substantial and annually increasing fertilizer bill should justify the public support of an adequately financed research program to improve the use of these fertilizer materials. The investment will be returned quickly and increased many times in increased production.

### Equipment

The proper use of fertilizers is severely handicapped in Oregon as elsewhere because of the lack of efficient fertilizer spreading equipment. Fertilizer spreading machinery has improved substantially in the past few years but farmers will unanimously agree that there is room for further improvement with broadcasting equipment. None of the equipment now available is completely satisfactory from the standpoint of accurate rates of application. Further improvements are possible in reducing possible damage by corrosion and in developing machinery that stands up under rough usage.

Better equipment for row applications and for deep placement are needed. Satisfactory equipment is not now available that will permit accurate placement of fertilizer in relation to the seed or to the growing crop.

To improve the use of fertilizer on field and pasture crops it would be helpful if practical equipment could be developed for the proper placement of fertilizer in any decided depth below the soil's surface.

## RECOMMENDATIONS

1. Oregon farmers should make full use of commercial fertilizers to the extent that their use brings back profitable increases in yield.
2. To make possible full utilization of fertilizer applications there is an imperative need in each agricultural area in the state for accurate and local information on the types of fertilizer to use, the rates and ratios of different plant foods, the time of application, method, and placement of applications. The Experiment Station should take immediate steps to launch an

extensive research program to supply immediate answers to these problems.

We believe that this can best be accomplished through the establishment of plot work in cooperation with farmers, but that adequate personnel and equipment be provided by the Experiment Station to assure the use of proper methods, accurate yield data, and the proper interpretation of results. Progress reports should be made available to farmers in the area on a yearly basis.

3. The Experiment Station should take immediate steps to establish a soil testing laboratory to which farmers could submit soil samples for analyses as an aid in determining proper fertilizer use. As a means of improving techniques, this laboratory should be operated in close cooperation with the fertilizer trial program suggested in 2 above.
4. Additional fertilizer trials should be established by farmers, by private agencies, and cooperatives interested in marketing or processing various crops. It would be helpful if this work were conducted in cooperation with the Experiment Station to avoid unnecessary duplication of work.
5. There is an opportunity for commercially operated soil testing laboratories providing they are operated to interpret results applicable to local farm conditions. The best immediate possibility is in the Columbia Basin.
6. To be assured of adequate fertilizer supplies, Oregon farmers should provide their own farm storage; and to be assured of adequate supplies of the proper materials, they should purchase and store materials as they are available.
7. We recommend that some segment of the fertilizer industry provide increased service to Oregon farmers through maintaining more adequate supplies of materials under proper storage near the point of use—within trucking distance of the farm. While the installation of such facilities would involve substantial investments it is quite probable that farmers in general would be willing to pay the increased cost to a point where the venture would be profitable. By extending concessions to those farmers who are able to purchase and store materials in advance of need such an enterprise could encourage rather than discourage farm storage.

There are some opportunities for savings through the establishment of storage facilities to serve convenient areas.

They are as follows :

- Car shipments could be made direct to the point of storage thus avoiding the cost of local freight and possible rehandling.
  - Manufacturers and major distributors would have a point of delivery continually available permitting uniform operation of manufacturing facilities.
  - It is quite probable that many processors and dealers now handling fertilizers as a service to their customers would turn this business over to a reliable concern, in this way increasing the volume of business.
  - Farmers would be willing to pay somewhat higher prices in return for the service rendered.
8. Substantially increased supplies of lime are a major need in western Oregon. The development of these supplies will require a substantial investment to obtain the necessary raw materials and to install efficiently operating machinery. Farmers should be willing to pay an adequate price for the delivered lime to assure the producer and the distributor a fair profit to maintain a continued stable supply.
9. As an aid in securing the more widespread use of lime the assistance available under the Agricultural Conservation Program of the Production and Marketing Administration should be continued until such time as the use becomes generally established.

## Soil and Water Resources Committee

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Resources Forum  
March 27 and 28, 1952

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