Hawaii Agricultural Experiment Station · College of Tropical Agriculture · Universtiy of Hawaii · Departmental Paper 32

Abstracts of Publications and Research Department of Agronomy and Soil Science College of Tropical Agriculture 1960-1974

VI. Agronomy

Peter P. Rotar, Editor

PREFACE

This series of six volumes of *Abstracts of Publications and Research, Department of Agronomy and Soil Science, College of Tropical Agriculture, 1960–74* details all the published research by members of the Department of Agronomy and Soil Science, University of Hawaii, and graduate student M.S. theses and Ph.D. dissertations prepared for degrees granted by the Department.

The volumes in this series include:

I. Crop Science–(1) Crop Breeding, Genetics and Tissue Culture; (2) Crop Physiology and Metabolism; and (3) Crop Quality and Utilization ..... (DP 27)
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V. Soil Science–(7) Soil Genesis, Morphology and Classification; (8) Soil Mineralogy; and (9) Forest and Range Soils ..... (DP 31)
VI. Agronomy–(1) Land Use and Management; (2) Climatology; and (3) Environmental Quality ..... (DP 32)

Within each numbered section, the publications are listed in alphabetical order by senior author and date of publication, then by alphabetical order of second author, and finally by alphabetical order of title. Abstracts of theses and dissertations are longer than abstracts of published papers. The table of contents in each volume lists the complete citation–author, date, title, and publication data–for each publication.

Each abstract may be cut out and individually mounted on a 5 x 8 notecard for easier filing.

The choice of category for certain abstracts may appear somewhat arbitrary, especially since some abstracts fit well into any one of several sections. Choice of section was made by the compiler. Not all of the department's research efforts are presented in these reports: some were inadvertantly missed; others fell by the wayside as deadlines were set and changed. These will all be published in an addendum at a later date.

The preparation of these reports was partially supported by funds from a USAID-2lld grant given to the department.

P.P.R.

The Editor

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Department of Agronomy and Soil Science
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VI. Agronomy

Peter P. Rotar, Editor

(1) Land Use and Management

Kanehiro, Y. 1967. Effect of surface soil removal on the development of zinc deficiency in Hawaiian soils. Hawaii Farm Sci. 16(1):1-3.

ABSTRACT

Amount of available zinc (as determined by a weak hydrochloric acid extraction) steadily declines with increasing soil depth. This especially is true of the highly weathered latosols of Hawaii.

Exposed subsoils, either naturally induced or man-induced, are very often associated with zinc deficiency. Such exposed subsoils are very low in available zinc. Indicator plants (corn) when grown in these soils respond to zinc application.

Some of the Hawaiian soils that are low in available zinc are also acid in reaction. Consequently, the decreased available zinc content in the subsoil cannot always be attributed to the presence of alkaline soil material.

additional index words: soil zinc, zinc deficiency, latosols

Motooka, P. S., D. L. Plucknett, and D. F. Saiki. 1968. New role for an old jungle. World Farming 10(8):26-29.

ABSTRACT

Steep wetland areas are prime candidates for conversion to tropical pastures in Hawaii. A 40 acre valley was cleared by aerial herbicide applications, followed by burning and aerial seeding and fertilizing. Green panic (Panicum maximum var. trichoglume) established well as the major grass. Legumes which established successfully after seed pelleting with methyl ethyl cellulose and TVA slag were: stylo (Stylosanthes guayanensis) on exposed ridgetops and upper slopes; Desmodium intortum which established in valley bottoms and lower slopes; Glycine wightii which grew best within the driplines of dead trees and Centrosema pubescens which grew occasionally on the lower slopes. Experimental costs for clearing and establishment were $100 per acre; costs for ranchers are estimated at $80 per acre to first grazing.

additional index words: land development, tropical pastures, aerial seeding, aerial fertilization, aerial application of herbicides, legume seed pelleting, pasture grasses

Periaswamy, S. P. 1973. Agricultural potential of forested lava lands (Tropofolists). M.S. Thesis, Department of Agronomy and Soil Science, University of Hawaii.

ABSTRACT

The Tropofolists cover 11% of the State and represents one of the largest potential agricultural lands. Under native vegetation, the forest floor is covered with varying thicknesses of organic matter, but once cleared and leveled for crops, the land surface becomes devoid of surface organic matter. The organic matter is either buried or filtered downward into the crevices of the crushed rocks. Under the latter conditions, evaporative water loss from the organic matter are considerably reduced. Efficient use of the Tropofolists, however, is governed by 3 parameters--rainfall, soil temperature, and texture of the underlaying rock. As reported in the previous annual report, cropping should take into consideration the climatic factors, and preference should be given to use of fragmented aa lava land rather than the lithic or pahoehoe lava land. An estimated 55,000 acres of Tropofolists are suited for macadamia, papaya, or other crops. There is a need for a detailed soil survey to delineate these areas.

additional index words: soil genesis, soil classification, soil characterization, histosols, tropofolists

Plucknett, D. L. 1960. Lava rock land can grow crops. Crops and Soils 12(9):19.

ABSTRACT

The system of farming volcanic rocklands on the island of Hawaii is described. In some cases fresh lava lands are being used to grow crops. Crops often grown include coffee, macadamia and guava as well as such vegetables as cucumber, tomatoes, papper, eggplant and ginger. In rock soils vertical erosion is a problem, and bagasse mulches are useful to protect from severe losses. Because leaching is rapid, fertilizer applications are applied frequently, often as short as two week intervals and are necessarily light.

additional index words: lava lands, marginal lands, vertical soil erosion, mulching, fertilization, tree crops, vegetable crops

Sherman, G. D., and D. L. Plucknett. 1960. Land reclamation in Hawaii. Crops and Soils 12:19.

ABSTRACT

Research on reclaiming stripmined bauxitic soils in Hawaii indicated phosphorus was the major deficiency limiting crop growth. Subsoils required more phosphorus than topsoils. From 30 to 90 days was the time required to revegetate the areas following simulated mining. Grass-legume combinations were more productive than grasses alone. With fertilization, the stripmined lands were improved beyond their previous status, as measured by crop yields.

additional index words: stripmined soils, bauxitic soils, forage production, fertilization, phosphorus deficiency, crop production

Shigeura, G. T., H. Ooka, G. Uehara, R. C. Jones, and R. L. Fox. 1971. Growing macadamia nut trees on aa land. 11th Annual Proc. Hawaii Macadamia Prod. Assoc. p. 19-23.

ABSTRACT

Scanning electron microprobe was used to estimate phosphorus and iron concentrations in the vicinity of macadamia roots from healthy and chlorotic trees. Iron appeared to be depleted in the soil near the roots of the chlorotic tree, especially at the soil root interface. Low iron was associated with higher phosphate. This leads to the conclusion that abnormally high soil phosphorus levels has rendered soil iron less mobile and less available to trees. Thus movement of iron by diffusion from the soil to roots may become a limiting factor in the iron nutrition of heavily fertilized macadamia.

additional index words: iron, phosphorus, macadamia, roots, organic soils (tropofolist)

Takahashi, M., J. C. Moomaw, and G. D. Sherman. 1961. Crop production trials on stripmined floor soil show promise. Hawaii Farm Sci. 10(1):2-5.

ABSTRACT

It was shown that stripmined floor soil could be reclaimed after the bauxite had been removed. Reclamation included the incorporation of high amounts of fertilizers and lime into the soil. This included 1500 lbs. per acre of raw rock phosphate and an initial 5000 lbs. per acre of coral. During cropping, topdressing of 400, 600 and 500 lbs./acre per year or 11 1/4-24-18 3/4 per acre applied at 3 month intervals, gave very satisfactory crop yields. Crops included vegetables, fruit trees, sugarcane, and pineapple.

additional index words: stripmined soils, crop production, reclamation, liming, fertilizers, bauxite

van't Woudt, B. D., and G. Uehara. 1961. Erosion behavior and control on a stripmined latosolic soil. Hawaii Agr. Exp. Sta. Tech. Bull. 46. 36 p.

ABSTRACT

Soil erosion and its possible control after stripmining was studied on an aluminous Humic Ferruginous Latosol during a 2-year period, when average rainfall conditions prevailed. The study was carried out in plots, 8 X 80 feet, to which various surface treatments were applied. Erosion was very small on surface-protected soil but 20 times as high on unprotected, compacted soil (compacted by the use of heavy machinery in stripping).

The study has been a model study of what happends beyond the plots and the similitude has not been a good one. On the unprotected soil this was caused by the plot boundary which probably caused soil losses measured to be in excess of those occurring beyond the plots. By contrast, soil losses measured on the surface-protected soil did not properly represent soil movement on the plots as gradually displaced soil on a slope was caught by surface roughness and tended to escape measurement at the foot of the slope. Even though this soil displacement could be qualitatively proved, the magnitude was so small that it escaped measurement by marked metal stakes inserted on the plots for this purpose.

Surface soil replacement on subsoil substantially reduced erosion because of (1) the high structural stability of the surface soil, (2) its high infiltration rate, and (3) the fact that the subsoil was scarified prior to surface soil replacement. A decision on whether or not to replace surface soil is guided by economics.

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On the basis of infiltration measurements and erosion behavior, it has been concluded that subsoil should be scarified immediately after stripping to destroy compaction in the surface few inches of the subsoil exposed after mining.

additional index words: erodibility, infiltration, compaction, self-mulding

Younge, O. R., and J. C. Moomaw. 1960. Revegetation of stripmined bauxite lands in Hawaii. Econ. Bot. 14(4):316-330.

ABSTRACT

Occurrence and distribution of the bauxite lands of Hawaii are presented, along with a characterization of the climate, topography, soils, and vegetation of these lands. Most of these lands are marginal or sub-marginal for agriculture and have often been abandoned from production. Most are now covered with an exotic growth of weeds and low-fertility requirement shrubs and grasses. Experiments are described which were designed to find ways to revegetate and rehabilitate these lands following bauxite stripmining. Major fertilizers required for revegetation were nitrogen, phosphorus, and potassium; however later responses to lime and zinc were obtained. Satisfactory revegetative growth was obtained only 10 weeks after planting, when heavy N P K fertilization was used, and a satisfactory economic crop of mixed pangolagrass-Desmodium intortum forage was obtained within 20 weeks after planting. Crop adaptation trials showed that a wide range of plantation crops, tree crops, forage crops, and vegetable crops can be grown on stripmined areas with good fertilization and management.

additional index words: aluminous soils, land reclamation, plant aluminum, forage crops, liming, nitrogen, phosphorus, potassium, fertilization, marginal lands

Younge, O. R. 1961. Fertility requirements of bauxite stripsoil for crop production. Hawaii Farm Sci. 10(1):6-8.

ABSTRACT

Stripsoil, the residual material left on the surface after stripmining for bauxite, is extremely infertile. Several fertility treatments were laid down on these soils, using test crops of sudangrass and mixed pangolagrass and Desmodium intortum. Proper seed bed preparation and heavy fertilization and planting to suitable crops, can provide a vegetative cover in 10 weeks after planting. Starting fertilizer requirements were: nitrogen 200 lb/ac, phosphorus 1000 lb/ac, and potassium 1000 lbs/ac. Delayed responses were found to lime at 5 tons/ac and zinc at 25 lbs/ac. On topsoil areas, 600 lbs/ac P appeared adequate. With phosphorus treatment, yields rise from near nothing with zero-P to high yields (14-16 tons dry matter per acre per year) with P 1000. Fertilization increased cattle-carrying capacity of these soils by 22 times on stripsoil and 7 times on topsoil, when compared with unfertilized areas.

additional index words: reclamation, phosphorus fertilization, nitrogen fertilization, potassium fertilization, liming, zinc fertilization, forage production, aluminous soils, marginal lands

(2) Climatology

Britten, E. J. 1960. Genetic and environmental control of flowering in Trifolium repens in the tropics. Science 131:100, 101.

ABSTRACT

Trifolium repens at low elevations expressed wide genetic variation in tendency to flower. Clones classified as flowering or nonflowering were subjected to temperatures associated with high elevations. Flowering in "nonflowering" clones was induced under warm-day:cool-night treatments. It is proposed that in the tropics, low temperatures associated with high elevations are an important factor in determining flowering, and therefore ability to persist, in plants which are long-day and temperature sensitive.

additional index words: environment, trifolium, pasture management, legumes, temperature

Britten, E. J., and D. M. Kinch. 1960. A low-cost controlled environment cabinet with diurnal temperature fluctuation. Ecology 41:801-803.

ABSTRACT

A method of modifying a surplus 75 cubic foot, five-door reach-in refrigerator for use as a growth chamber is presented. Cost of the conversion not including labor was $250.00. The modified cabinet allows for control of day length and temperature.

Practical results: an inexpensive way of making a growth chamber for control of flowering, etc., both for the amateur gardener as well as for the researcher.

additional index words: environment, growth chamber

Britten, E. J, 1961. The influence of genotype and temperature on flowering in Trifolium repens. Agron. J. 53:11-14.

ABSTRACT

Three sets of experiments are described in which clones of white clover were grown under different conditions of temperature. The clones differed in their ability to flower under sea level conditions. The first experiments conducted as field tests indicated that clones which did not flower at sea level could be induced to flower by growing them at high elevation. A second series of tests performed with plants in pots confirmed these results and eliminated certain complications in the field experiments. A third set of experiments with plants in a controlled environment cabinet showed that those plants which failed to flower at low elevation could be induced to flower by cold night treatments. These results are important from the standpoint of gene action in white clover. Since flowering is a problem of great importance in this species, specific information on genetic and environmental influences on this phenotypic character is of value. The results help to explain the distribution of white clover in a tropical area and also suggest practical applications for breeding and seed production purposes.

additional index words: trifolium, legumes, genotype, environment, seed production

Ravoof, A. A., R. L. Fox, and W. G. Sanford. 1973. Low soil temperatures depress root activity in the tropics. Illustrated Concepts in Trop. Agr. 6:1.

ABSTRACT

Uptake of N, P, and K by pineapple approaches maximum when root temperature is 25 C. At 15 C roots became suberized and crowns lost weight by dessication. In January uncovered soil temperature at 7.5 cm depth at Wahiawa was 20.7 C while soil covered with black plastic was 23.2 C.

additional index words: pineapple, soil temperature, root activity, nutrient uptake, nitrogen, phosphorus, potassium

Yoder, Ronald C. 1968. Effects of thermoperiod on the stomatal opening and transpiration of pineapple (Ananas comosus (L.) Merr.). M.S. Thesis, Department of Agronomy and Soil Science, University of Hawaii.

ABSTRACT

Pineapple leaf area can be satisfactorily estimated from measurements of leaf length. A correlation coefficient of 0.98 was obtained between the logarithm of leaf length and the logarithm of leaf area. The equations were slightly different for these two different clones examined.

Thermoperiod effects on transpiration were examined in a controlled environment chamber. Transpiration rates from small pineapple plants did not exceed 0.3g/dm^2/hr, values less than half those reported for other crop plants. Higher transpiration rates were obtained at 25 C than at 35 C even though prevailing evaporation rates were lower at the lower temperature. Transpiration rates were highest during the day at all thermoperiods.

When transpiration was corrected to a unit evaporative demand basis (transpiration rate/evaporation rate of an atmometer), apparent leaf diffusion resistances (apparent R_2) were uniformly low during the 35 C day but increased as night temperature was decreased from 35 C to 20 C. Apparent R_2 was lower at the 25 C day than at 35 C. Night temperatures, equal to or greater than day temperatures, resulted in increased apparent R_2 at night. When the night temperature was lower than the day temperature, apparent R_2 was high in the day and low at night. At constant thermoperiods, transpiration rates increased and day apparent R_2 decreased with temperature to 30 C

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and then declined. At night, transpiration rates remained nearly constant while apparent R_2 increased with increasing temperature. The implication with respect to CO_2 and water relations of pineapple are discussed.

additional index words: pineapple, thermoperiod, transpiration rates

(3) Environmental Quality

Green, R. E., and Y. Kanehiro. 1970. Soil and water pollution by agricultural chemicals. Proc. 4th Annual Hawaii Fert. Conf. Univ. of Hawaii, Coop. Ext. Serv., Misc. Pub. 68. p. 3-20.

ABSTRACT

Several factors contribute to the contamination of groundwater and surface waters by agricultural chemicals: nature of the chemical, characteristics of the land (topography, infiltration), climate, and soil and crop management. In Hawaii, groundwaters are subject to contamination by mobile chemicals such as nitrogen in the form of nitrate. Most pesticides used in agriculture are either readily degraded in the soil or only slightly mobile because of adsorption on soil colloids. In view of the continuous use of fertilizers and pesticides in Hawaiian agriculture, research is needed to define safe use of chemicals and provide other information needed for rational legislation on the use of agricultural chemicals.

additional index words: pollution, fertilization, pesticides, water quality, soil management

Uehara, G., and R. C. Jones. 1971. Research to enhance life's quality. Hawaii Farm Sci. 20(2):1-4.

ABSTRACT

The purpose of this article is to cite a few examples of agricultural research which have immediate application to bettering life's quality in Hawaii. Deep soils which occur on steep slopes, and which are classified as chromusterts, are not recommended for use as homesite. The problem of revegetation which confronts land developers and highway engineers is identical to the one which agronomists encountered 20 years ago. Miners who inhale silicious dusts over many years sometimes are affected with a disease known as silicosis. A more common complaint of Hawaii's homeowners is with windbrown dust that soils and reddens expensive draperies and carpets. Research on particulate matter in the air constitues only a small part of agricultural climatology. The greatest effort has been placed in discovering fundamental relations between climate and organisms.

additional index words: chromusterts, silicosis

Young, H. Y., and A. Chu. 1974. Heavy metals in waters, sediments, and soils of Hawaii. Proc. 7th Annual Hawaii Fertilizer Conf. Univ. of Hawaii, Coop. Ext. Serv., Misc. Pub. 116. p. 24-36.

ABSTRACT

Analysis of coastal waters at Kahana, Hawaii Kai and Kilauea for heavy metals show, with few exceptions, nondetectable amounts of mercury and cadmium and traces of arsenic, lead, chromium, nickel, copper and zinc well within published levels in seawater. Similar analysis of coastal sediments shows traces of mercury and cadmium and small amounts of arsenic, lead, chromium, nickel, copper and zinc. The levels of chromium, nickel, copper, and zinc indicate a definite relationship with levels found in the coastal soils. At Kahana and Hawaii Kai, a decreasing gradient of concentration from land to sea is evident, indicating a movement of minerals in this direction, largely due to rainfall and tidal action. Lead, cadmium, and mercury in sediments and soils do not show this trend since their levels are relatively uniform. The proportionally higher content of lead in sediments than in soils as compared to other elements may be indicative of an external source for lead. Monitoring of atmospheric and plant- and soil-sorbed lead is advised. Analysis of samples from miscellaneous coastal areas show that the areas having high industrial activity contain the highest levels of heavy metals.

additional index words: heavy metal pollution, population effects

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