

## DERMATOLOGIC DISORDERS IN AGRICULTURE

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There were 2,370,000 farms in the United States in 1983.<sup>20</sup> In 1982, 869,837 farms employed 4,855,857 hired workers,<sup>15</sup> and 60% of these workers are employed on farms that hire 10 or more workers.<sup>15</sup> Farmers and agricultural workers perform a wide variety of tasks that include tilling the soil, preparing and applying fertilizers and pesticides, harvesting crops, feeding and care of livestock, repairing equipment, and cleaning and maintaining buildings.<sup>1</sup> Many farmers work in isolation. Long work days and nights are required during busy periods of the year.<sup>15</sup> Many workers are employed for less than 25 days a year in agriculture.<sup>20</sup>

Farmers and other agricultural workers are exposed to a wide variety of chemical, biologic, and physical hazards at work. The precise prevalence and incidence of skin diseases in agriculture is unknown. Illness reports from workers' compensation are inadequate to assess the incidence of occupational skin disease because self-employed farmers are excluded from workers' compensation laws in most jurisdictions. In certain jurisdictions voluntary coverage by workers' compensation boards is available for self-employed farmers, but most farmers do not elect for such coverage. In Saskatchewan, for example, only 1,092 out of 67,000 farmers elect coverage by workers' compensation despite relatively low annual assessments for such coverage.<sup>20</sup> Many agricultural workers are transients who may not report occupational diseases.<sup>1</sup> Most centers for occupational medicine are located in urban areas and may not emphasize occupational disorders in agriculture. Despite these difficulties in assessing the prevalence and incidence of occupational skin disease in agriculture, the agricultural sector was noted to have the highest rate of occupational skin disease of any industry in California.<sup>41</sup> The risk of occupational skin disease was four times higher in agriculture than the all-industry average risk. The rate of occupational skin disease in agriculture was twice as high as the rate in the manufacturing sector. Occupational skin disease usually accounts for 40% of all occupational disease, but occupational skin disease accounted for approximately 70% of all occupational disease in agriculture in California.<sup>41</sup>

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Dermatologic Disorders in Agriculture

The risk and types of occupational skin disease vary with the crops, livestock, farming practices, and climate of an area. This article will emphasize occupational skin disorders most prevalent in agriculture in the midwestern section of North America. Contact dermatitis, zoonoses, and skin cancer in agricultural workers will be reviewed.

## CONTACT DERMATITIS

### PLANTS

In California allergic contact dermatitis to poison oak was the most frequently reported occupational skin disease in agriculture.<sup>41</sup> The antigen in poison oak, poison ivy, and related plants is an oleoresin, urushiol.<sup>7</sup> An acute erythematous vesicular eruption develops in areas of the skin that came into contact with the offending plant in individuals sensitized to urushiol. Owing to the linear deposition of urushiol on the skin, lesions are characteristically linear in distribution. Compresses with normal saline or Burrow's solution are helpful, but treatment with systemic corticosteroids is required for severe cases of poison oak or poison ivy dermatitis.<sup>22</sup>

Compositae plants are second in importance to poison oak and poison ivy in North America in agriculture, as they represent 10% of the flowering plants of the world (Table 1).<sup>4,45,50</sup> A large number of Compositae plants contain sesquiterpene lactones, which can cause allergic contact dermatitis in humans.<sup>4</sup> Individuals allergic to one Compositae plant are not infrequently allergic to related Compositae plants.<sup>7,12</sup> Allergic contact dermatitis to ragweed and other Compositae plants has been reported in farmers and grain elevator workers in North America.<sup>12,34</sup> The antigen in ragweed that causes allergic contact dermatitis is ether-soluble, unlike the water-soluble ragweed antigen that gives rise to hay fever.<sup>55</sup> Airborne plant material (trichomes) may be important in the perpetuation of cases of chronic dermatitis in sensitized individuals.<sup>50</sup> Allergic contact dermatitis to Compositae plants such as ragweed affects predominantly middle-aged men and is rare in women and children.<sup>12,50</sup> The eruption is at first seasonal but may



Figure 1. Compositae dermatitis.

Table 1. Compositae Plants That May Cause Allergic Contact Dermatitis in Agriculture

Ragweed	Burweed
Feverfew	Chrysanthemum
Pyrethrum	Chicory
Sneezeweed	Endive
Chamomile	Lettuce
Goldenrod	Artichoke
Dahlia	

become very persistent and widespread.<sup>7,12,50</sup> The affected workers typically present with a chronic lichenified eruption on the face, especially the upper eyelids, anterior and lateral neck, and other exposed body areas (Fig. 1).<sup>7,12,50</sup> Thousands of cases of severe allergic contact dermatitis to the Compositae plant feverfew have occurred in India since feverfew was introduced there in the form of cereal grains from the southern United States.<sup>50</sup> Twelve deaths, mostly due to exfoliative dermatitis, have occurred in India due to severe dermatitis caused by feverfew.<sup>44,50</sup>

We have recently performed two surveys on pruritus due to grain dusts in a large number of grain elevator workers.<sup>30</sup> From 51.9% to 62.8% of all workers complain of pruritus following skin contact with grain dusts, especially barley and oat dust. Younger workers were significantly more likely to complain of pruritus following exposure to grain dusts than were older workers. This probably indicates a healthy worker effect in older workers.<sup>11</sup> The pruritus provoked by grain dusts is transient in the majority of exposed workers; however, 13.1% of workers complained of a rash of variable duration following exposure to grain dusts. Grain dusts contain many components, including fragments of grain trichomes with size and shape characteristics similar to those of fiberglass fibers known to provoke skin irritation.<sup>26,27</sup> Allergic contact dermatitis to grain dusts has occasionally been reported,<sup>17</sup> but it is important to exclude allergic contact dermatitis to ragweed or other Compositae that may be in grain dust.

As a result of the adverse health effects of grain dusts the American Conference of Governmental Hygienists has recently recommended that the threshold limit value for grain dusts in the workplace be reduced from 10 mg/m<sup>3</sup> (nuisance dust) to 4 mg/m<sup>3</sup>.<sup>51</sup>

Among the crops that have been implicated in irritant contact dermatitis are tobacco, onion, hops, radish, asparagus, and carrots.<sup>7</sup> Phototoxic dermatitis due to parsnips, pinkrot celery, and citrus occurs in agricultural workers.<sup>7</sup> These plants contain photosensitizers. Two recent texts summarize the various dermatoses produced by a wide variety of plants.<sup>7,45</sup>

## PESTICIDES

There is increasing use of pesticides, especially herbicides, in agriculture. In 1976 more than 165 herbicides were available for use by American farmers.<sup>1</sup> In western Canada 17 million kilograms of herbicides are used each year in agriculture.

Under field conditions the skin is the organ most exposed to pesticides.<sup>65</sup> Farmers and agricultural workers are exposed to pesticides while mixing, loading, and spraying pesticide formulations as well as while cleaning spray equipment and disposing of pesticide containers.<sup>66</sup> There is no certification program to ensure that farmers and other agricultural workers are competent to use pesticides and agricultural chemicals safely.<sup>14</sup> Most farmers and agricultural workers do not always employ adequate skin protection when

using pesticides. Surveys in Saskatchewan indicate that only a minority of farmers always use skin protection while handling pesticides.<sup>2,29</sup> Lack of adequate skin protection when using pesticides is most likely to occur in hot weather or during very busy work periods. Adequate washing facilities are usually absent in the fields where the pesticides are being applied and most farmers cannot afford expensive safety equipment. Barrier creams have not proved to be effective in protecting the skin from pesticides. Ordinary laundering is not a very effective way to remove pesticide residues from clothing. The degree of contamination of the worker's skin and clothing by pesticides also varies with the skill and attitude of the applicator, type of pesticide spray (low-volume concentrate, conventional spray, etc.), type of crop (orchard or row crop), wind, and quality of spray equipment.<sup>66</sup>

In California pesticides were second to poison oak as the reported cause of occupational skin disease in agriculture.<sup>41</sup> The pesticides associated with the largest number of cases of skin injury in California were inorganic sulfur, omite, petroleum and coal tar derivatives, and methyl bromide.<sup>47</sup> Many of these cases were probably irritant contact dermatitis, but severe allergic contact dermatitis due to various pesticides has been well documented (Table 2 and Fig. 2).<sup>18,19,24,31,54</sup> Certain pesticides have been shown to be strong sensitizers experimentally even though proven cases of allergic contact dermatitis to pesticides are not frequently reported.<sup>31,36,43</sup> It has been suggested that the dilution of pesticides prior to their use in the field minimizes their capacity to sensitize exposed workers since induction of sensitization requires a minimal concentration of an allergen.<sup>36,43</sup> Once individuals are sensitized to pesticides they may react on patch testing to

Table 2. Pesticides Reported to Cause Allergic Contact Dermatitis

<i>Insecticides</i>	
Pyrethrum	Rodannitro-benzene
Rotenone	DDT
Lindane	Omite
Malathion	Dazomet
Naled	Dinobuton
Ditalimfos	
<i>Fungicides/antibacterials</i>	
Anilazine	PNCB
Captan	Streptomycin
Difolatan	Benomyl
Maneb	Dinobuton
Zineb	Dithianone
Mancozeb	Thiram
Plondrel	Nitrofen
<i>Herbicides</i>	
Propachlor	Nitrofen
Radox	Dazomet
Barban	Lasso

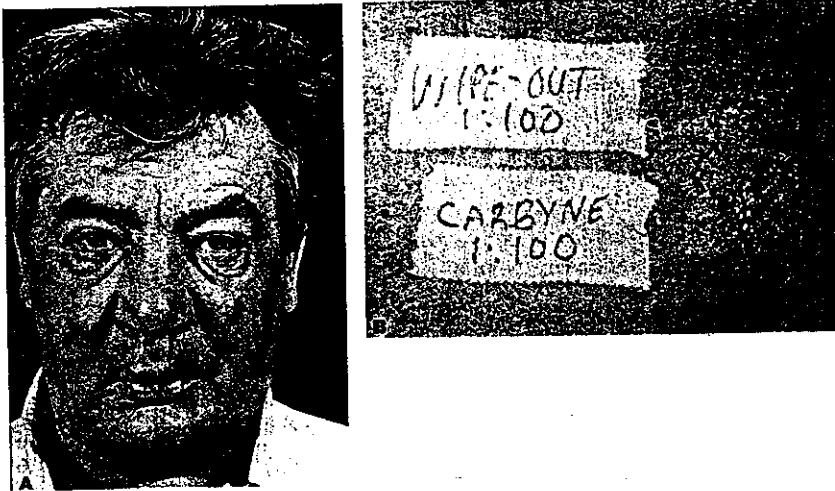


Figure 2. A, Allergic contact dermatitis due to the herbicide barban. B, Positive patch tests at 48 hours to commercial preparations of barban.

dilutions of the pesticide in acetone as low as 1 in 1,000,000.<sup>31,43</sup> Contact dermatitis may be the main adverse health effect of certain pesticides in humans. Phenothiazine insecticides and the herbicide glyphosate have been reported to cause phototoxic dermatitis.<sup>1,28</sup> Certain highly toxic pesticides such as the organophosphate parathion are rapidly absorbed through the skin without producing any dermatitis. Severe neurologic symptoms or death has been reported following percutaneous absorption of certain organophosphate pesticides.<sup>60</sup>

Pesticide sprays contain emulsifiers, adjuvants, carrier liquids, and surfactants. Pesticide formulations with a pH of less than 5 or a pH of more than 8 are skin irritants. To prove that a case of allergic contact dermatitis is due to a particular pesticide it is necessary to perform patch testing to a nonirritating concentration of analytic-grade pesticide in an appropriate vehicle. Contaminants may be the main allergen in pesticide formulations. For example, diethyl fumate was found to be a sensitizer in technical-grade malathion.<sup>36,43</sup> A recent article by Fisher suggests appropriate dilutions of various pesticides for diagnostic patch testing.<sup>24</sup> Predictive tests to assess a pesticide's capacity of inducing allergic contact dermatitis is now required prior to registration of a pesticide for sale.<sup>52</sup>

## OTHER CAUSES

Ethoxyquin, cobalt, and other feed additives have been reported to cause occupational dermatitis in agricultural workers.<sup>1</sup> The antibiotic spiramycin was found to be the chief cause of allergic contact dermatitis among farmers in a recent survey in Denmark.<sup>61</sup> In veterinarians penicillin is an important

cause of allergic contact dermatitis.<sup>23</sup> Neomycin and sulfonamides are other well-known sensitizers used as veterinary medications. Urticaria due to contact of the blood, hair, internal organs, placenta, amniotic fluid, and saliva of animals have been reported.<sup>13</sup>

## ZOONOSES

Skin infections have been stated to be second in importance to contact dermatitis as a cause of occupational skin disease.<sup>42</sup> Dermatophyte infections (ringworm, tinea) are the commonest occupational skin infections.<sup>42</sup> Farmers and ranchers are among the workers at risk of contracting these infections from animals.

### TINEA

Dermatophyte infections due to zoophilic fungi account for a majority of dermatophyte infections in farmers. Zoophilic fungi provoke a much more intense reaction in humans than do anthropophilic fungi. These severe local reactions include kerions and suppurative folliculitis (Fig. 3). Zoophilic dermatophytes that may produce skin infections in agricultural workers include *Trichophyton mentagrophytes*, *T. verrucosum*, and *Microsporum nanum*. Diagnosis of dermatophyte infections may be confirmed by microscopic examination of skin scrapings from a lesion appropriately prepared. Mycologic culture of skin scrapings from a skin lesion allows the identification of the fungal species.<sup>26</sup> The intense inflammation in humans provoked by certain zoophilic fungi may interfere with the procurement of a positive isolate of a dermatophyte.

*T. mentagrophytes* is more common in rural areas of North America than in urban areas.<sup>32,35</sup> It is the most frequently isolated dermatophyte in Alberta and Saskatchewan.<sup>16,48</sup> *T. mentagrophytes* was the commonest dermatophyte isolated in Saskatchewan farmers.<sup>32</sup> Facial infections due to *T. mentagrophytes* were common in this study. *T. mentagrophytes* infects a wide range of animals including small rodents. Fungal spores from infected rodents may contaminate cereal grains, and *T. mentagrophyte* infections in farmers have been reported following contact with grain contaminated with this organism.<sup>35</sup>

*T. verrucosum* continues to be a major cause of tinea faciei and tinea corporis in Saskatchewan and was the second most commonly isolated dermatophyte among farmers in Saskatchewan. *T. verrucosum* is the main cause of ringworm in cattle. These infections are most common in both cattle and human during winter months.<sup>25</sup> Young cattle are more susceptible to *T. verrucosum* than older cattle, and the crowding of cattle in barns and pastures in the winter months favors the spread of *T. verrucosum* infections among cattle. Fomites such as corrals may be important in the spread of *T.*



Figure 3. Extensive *T. verrucosum* infection.

*verrucosum*, as the spores of this fungus remain viable in the environment for at least one year. Since it is not economically feasible for farmers and ranchers to treat all cattle with *T. verrucosum* infections, disinfection of fomites and the wearing of gloves when handling infected cattle are important measures in preventing *T. verrucosum* infections in humans.<sup>5</sup> *T. verrucosum* infections in humans may be quite disfiguring and may cause scarring. Early diagnosis is essential for effective treatment of affected workers. Anti-inflammatory agents, including systemic corticosteroids, are frequently required in addition to griseofulvin in the treatment of kerions.

Dermatophyte infections in humans due to *M. nanum* are relatively infrequent, though this organism is an important cause of ringworm in pigs.<sup>5</sup>

## VIRUSES

Certain zoonotic viral infections of humans are highly characteristic in their clinical appearance. Orf (contagious ecthyma) is a poxvirus infection

(Fig. 4) that commonly affects sheep, especially lambs.<sup>5</sup> Infected lambs must be bottle-fed because of the oral lesions of orf, so there is ample opportunity for those feeding the lambs to become infected.<sup>5</sup> Orf may also be spread by contaminated fomites. The typical lesion in humans is a hemorrhagic bulla after an incubation period of 5 or 6 days. Hypersensitivity skin reactions, usually similar to erythema multiforme or toxic erythema, may occur before resolution of the primary lesion.<sup>64</sup> Most cases of orf are relatively mild and self-limited, though one death has been associated with widespread lesions of orf.<sup>64</sup> There is an effective animal vaccine for orf, and early vaccination of a herd will help prevent cases of orf in farmers and agricultural workers.<sup>5</sup>

Bovine papular stomatitis and pseudo-cowpox produce lesions in humans similar to those of orf.<sup>10,49</sup> Bovine papular stomatitis is a parapoxvirus that produces oral lesions in otherwise healthy cattle. Pseudo-cowpox (milker's nodules) is a contagious viral disease of cows that affects their teats. Unlike orf, pseudo-cowpox is transmissible among humans. The virus is similar to the virus that causes orf. The clinical diagnosis of orf, bovine papular stomatitis, or pseudo-cowpox may be confirmed by electron microscopy and tissue culture of appropriate specimens.

## MITES

Grains may be contaminated by the mite *Pyemotes ventricosus*. This mite parasitizes a broad range of insects and is especially common in the midwest in years that have mild winters. These mites may attack humans, and the lesions may be minimal or bullous. Epidemics of papular urticaria have occurred from grains and straws containing large numbers of these mites.<sup>8</sup>

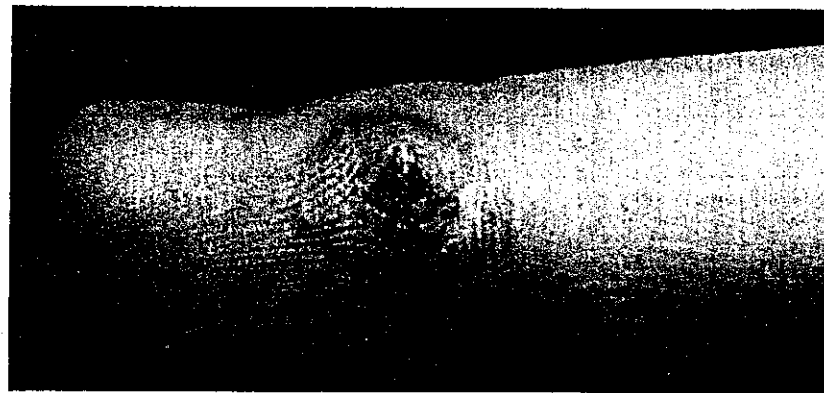


Figure 4. Orf.

Fowl mites, especially *Dermanyssus gallinae*, have been reported to cause occupational skin disease in exposed workers.<sup>9</sup>

Animal scabies may be transferred from animals to humans, though unlike *Sarcoptes scabiei* var. *hominis* a persistent skin eruption does not occur since animal scabies cannot complete their life cycle on humans.<sup>9</sup> Diagnosis may be confirmed by observing the mite in lesional skin scrapings reviewed under a microscope. Infected animals may be treated with organophosphate insecticide preparations.<sup>5</sup>

## SKIN CANCER

Skin cancer is more common in farmers than nonfarmers even though farmers have a lower overall rate of cancer than nonfarmers.<sup>6,29,63</sup> Chronic exposure to ultraviolet light is recognized as the main cause of nonmelanoma skin cancer in man.<sup>21</sup> Individuals with light skin color, who tan poorly, sunburn easily, and freckle easily following exposure to ultraviolet light are at the greatest risk of developing skin cancer.<sup>21,29</sup> Multivariate analysis of risk factors for skin cancer in 870 individuals with a recent diagnosis of skin cancer in Saskatchewan and 1230 age-, sex-, and location-matched controls demonstrated that agricultural occupations were a significant risk for nonmelanoma skin cancer (Tables 3 to 5).

Squamous cell carcinoma is the type of skin cancer most strongly associated with chronic ultraviolet light exposure.<sup>46</sup> Squamous cell carcinoma of the lip is more prone to metastasis than squamous cell carcinoma of the skin. Squamous cell carcinoma of the lip presents as a firm nodule that eventually ulcerates (Fig. 5A). Almost all cases occur in men, most often on the lower lip. There is usually a pre-existing or concurrent actinic cheilitis<sup>46</sup> (Fig. 5B). In Saskatchewan 61% of cases of squamous cell carcinoma of the lip occur in farmers or ranchers. In cases of actinic cheilitis, where squamous cell carcinoma has been excluded, treatment with topical 5-fluorouracil,

**Table 3.** Main Occupation of Patients with Squamous Cell Carcinoma of the Lip and Controls in Saskatchewan

	CASES (N = 63)	CONTROLS* (N 92)
Farmer, rancher, farmer's wife	60.3%	46.7%
Construction, oilfield, railway, roadwork, outdoor maintenance	9.5%	4.3%
Clerical teaching, housewife	4.8%	9.8%
More than one occupation	15.9%	8.7%
Other (including mining)	9.5%	30.4%
Total	100%	100%

\*Age-, sex-, and location-matched.  
 $p = 0.01$

**Table 4.** Main Occupation of Patients with Squamous Cell Carcinoma of the Skin and Controls in Saskatchewan

	CASES (N = 171)	CONTROLS* (N = 280)
Farmer, rancher, farmer's wife	50.9	32.9
Construction, oilfield, railway, roadwork, outdoor maintenance	5.8	5.7
Clerical, teaching, housewife	10.5	23.6
More than one occupation	14.0	15.4
Other (including mining)	18.7	22.5
Total	100	100

\*Age-, sex-, and location-matched.  
 $p = 0.0007$

cryosurgery or lip shave with scalpel or carbon dioxide laser is effective. Squamous cell carcinoma of the lip must be treated with surgical excision or radiotherapy.

Squamous cell carcinoma of the skin generally arises from sun-damaged skin. These squamous cell carcinomas have a low propensity to metastasize. A squamous cell carcinoma of the skin most commonly presents as a shallow ulcer surrounded by a wide, elevated, indurated border. Many squamous cell carcinomas of the skin develop from pre-existing actinic keratoses. Squamous cell carcinoma of the skin are treated with surgical excision, radiotherapy, curettage, and electrodesiccation or cryotherapy using repeated prolonged freezes with liquid nitrogen.<sup>3</sup>

Actinic keratoses are squamous cell carcinomas in situ.<sup>39</sup> Actinic keratoses are covered with a rough scale and typically are easier to palpate than to see (see Fig. 5B). Actinic keratoses occur on areas chronically exposed to ultraviolet light and are usually accompanied by other skin changes due to chronic solar damage, such as premature wrinkling of the skin, actinic

**Table 5.** Main Occupation of Patients with Basal Cell Carcinoma and Controls in Saskatchewan

	CASES (N = 525)	CONTROLS* (N = 732)
Farmer, rancher, farmer's wife	39.6%	28.7%
Construction, oilfield, railway, roadwork, outdoor maintenance	3.2%	6.3%
Clerical, teaching, housewife	23.8%	27.5%
More than one occupation	12.6%	14.2%
Other (including mining)	20.8%	23.4%
Total	100%	100%

\*Age-, sex-, and location-matched.  
 $p = 0.0006$

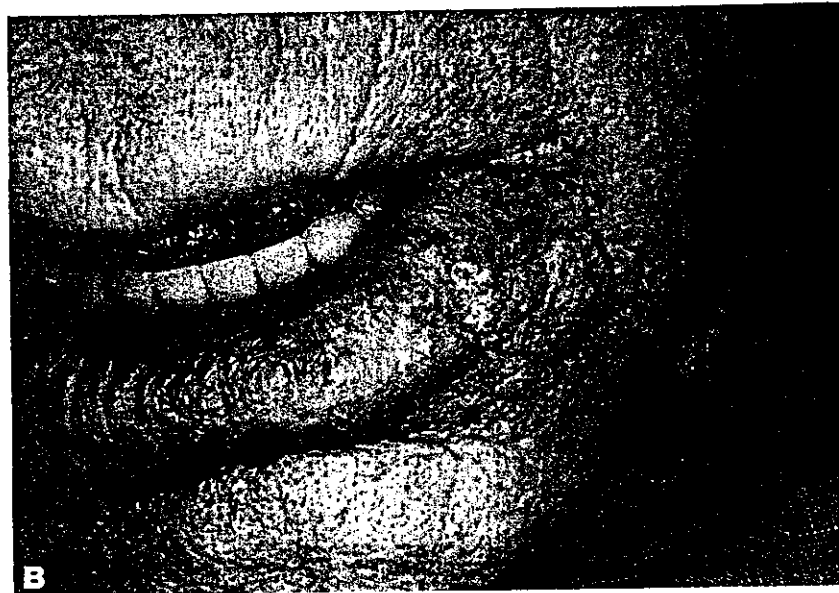


Figure 5. *A*, Squamous cell carcinoma of the lower lip. *B*, Actinic cheilitis and actinic keratoses.

elastosis, and telangiectasia. A few actinic keratoses progress to invasive squamous cell carcinoma. Cryotherapy with liquid nitrogen has a cure rate of almost 100% for actinic keratoses.<sup>40</sup>

Basal cell carcinoma of the skin, the commonest skin cancer, has a very low rate of metastasis but is locally aggressive and may be highly destructive of vital structures if left untreated. Basal cell carcinomas characteristically present as pearly papules or nodules that frequently ulcerate (Fig. 6). Ulcerated basal cell carcinomas are commonly termed "rodent ulcers" and are treated with the same modalities as squamous cell carcinoma of the skin.<sup>3</sup>

Unlike nonmelanoma skin cancers, a statistical association between malignant melanoma of the skin and agricultural occupations has not been proved though lentigo malignant melanomas have been associated with chronic exposure to ultraviolet light.<sup>33</sup>

A recent survey found that farmers, ranchers, and their spouses in Saskatchewan were less aware of the association between exposure to sunlight and the development of skin cancer than were other occupational groups. Only 10% of farmers and ranchers under 65 years of age used sunblocks. When sunblocks with a sun protection factor of 2 or greater were used on laboratory animals, the development of skin cancer due to ultraviolet light was prevented.<sup>37</sup> A sunblock with a sun protection factor of at least 15



Figure 6. Basal cell carcinoma.

is recommended for agricultural workers who sunburn easily. Effective sunblock preparations are available in alcohol lotion and in moisturizing lotions and creams. Tightly woven fabrics such as cotton offer superior protection to ultraviolet light, are more economical than sunblocks, and should be used where practical.<sup>57,62</sup>

Exposure to 2,4-D and 2,4,5-T has not been demonstrated to increase the risk of skin cancer in workers.<sup>29,59</sup> Exposure of agricultural workers to arsenical insecticides in the past may have increased their rate of skin cancer, but this association could not be confirmed in our study.

Approximately 15% of agricultural workers in Saskatchewan with skin cancer noted a past history of trauma or frostbite to the involved area. The possible role of trauma and frostbite in the subsequent development of skin cancer is not yet fully elucidated, though such an association has been legally accepted.<sup>53,58</sup>

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