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considerable study. The action of frost on soils can be favourable or unfavourable depending on the soil texture, organic matter content, moisture content, the rate of freezing, frequency of thaws and depth of freezing. Buckman and Brady have indicated that the force developed by the freezing of water is an almost irresistible force equivalent to about 150 tons of pressure to the square foot. That soil moisture content, then, is important in considering frost effects on soils is easily understood.

It is generally considered that frost action is beneficial. It is believed that alternate freezing and thawing causes a granulating effect on soils and may help overcome compaction caused during the regular playing season. Baver states that freezing and thawing do not always result in improved soil conditions, however. If the soil is dry during the winter there will be little change in aggregation, and, if it is excessively wet there may actually be a dispersion of aggregated materials.

It is usually possible, and certainly desirable, to make sure that greens do not go into the winter in a dry state. It is not possible, generally, to regulate soil moisture in late winter, however, when the frost starts to leave the soil. Since thawing commences at the soil surface any excess water is trapped at the surface by frozen soils below. It is customary to have periods in late winter or early spring when the surface soil is saturated. It is during this period that traffic damage to the soil is most likely and most lasting.

Traffic on these "fluid" soils not only causes visible injury but actual puddling can occur with a subsequent loss of aeration and drainage. It is difficult to maintain adequate soil aeration and surface drainage under heavy play on golf greens when play is confined to the growing season. When traffic is permitted on soils that are waterlogged as a result of frost action, all benefits of a good greens management programme may be overcome rapidly. Certainly the benefits occurring

as a result of alternate freezing and thawing will be lost.

Winter play on golf greens is most likely to cause injury in late autumn or early winter and again in early spring. The injury caused by this play is primarily mechanical—*bruising* resulting from play on frosted turf when the grass is not completely dormant, or *attrition*, actual wearing out of the grass at a time that it cannot be renewed. A second type of injury is to the soil. This is most serious during the time the soil is thawing and shortly thereafter.

There are several ways to lessen damage from winter play. The most obvious is to provide small temporary "greens" near the regular green for winter play. Since the surface of a green seldom provides a good putting surface under frozen conditions and golfers are generally more interested in exercise than in score at this season, the temporary "greens" are generally acceptable. *Some superintendents provide extra large cups in the winter "greens" to help compensate for poor winter putting conditions.*

Another method used to reduce injury in late autumn is to water the greens lightly in the mornings to remove the frost from the grass before permitting play. Many courses close for play on the days the superintendent feels the injury potential is high.

It is well to keep the membership informed of the damage potential from winter play. If winter play is regular, an additional budget item should be requested as some repair work will be necessary with the arrival of spring.

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SITUATION VACANT

ASSISTANT GREENKEEPER/
GROUNDSMAN wanted. Good wages and conditions for right applicant. Sudbury Golf Club, Bridgewater Road, Wembley, Middlesex (telephone 902 3713).