

Longterm grasslandexploitation at Schiphol Airport AmsterdamPreface

This article came, in the first place, into being to report on the influences of the successive ways of use and maintenance of the grassed surface going with the run- and taxiways in control with the Airport Authority.

It was examined whether the present maintenance of the grassplot still meets the operational requirements.

Furthermore there comes up for discussion the cost accounting of the benefit and cost trend in the different ways of maintenance. The way of approach can also be of help with changes in control and maintenance which will become necessary in the coming years because of retrenchment policy of governmental departments.

Finally the article will serve as a basis for the Working Group Aerodromes of the Bird Strike Committee of Europe.

In it the matter will be raised of grasscontrol in connection with the prevention of birds in relation with the used lengths of the grass and the technical and economic aspects of the latter.

Grassmaintenance has, through the years, been a matter of concern and study for Schiphol Airport.

It will hardly be possible to point out any grassland about which so much is known, written and spoken.

Adjusted grassland control has taken place at Schiphol for more than sixty years.

The aims of control are more focused on flightsafety and minimalizing of maintenance costs but were formerly also focused on production, in combination with the aforementioned aims.

In the following article we will go further into the matter of the present control, in the light of historical-, soilscience-, hydrological- and vegetational aspects.

History

In the early twenties an area, located in the north-eastern part of the Haarlemmermeer polder, was designated as aviation ground.

First only for pure military use; later on for combined military and civil use; finally for civil aviation only.

In the first years, aviation was taking place on more or less levelled, mowed grassland. For this purpose arable land was turned into grassland. The maintenance of the grassland was exclusively designed to offer facilities for taking off, landing and taxiing. Although the cut grass was used as cattlefodder.

The first paved runways and aprons date before World War II. After this innovation, aircraft did not use the grass anymore, except in case of emergency.

During the war, Schiphol became of course a military airfield again. In that period the soil was considerably enriched with steel and debris. After the war the field became a civil airfield again which grew along with Civil Aviation in general, actually it outdid that grow, until it reached its well-known area of 1700 ha. with four primary runways. As mentioned before the use of grassland changed when the paved runways came into use.

The existing grassland at Schiphol is either for agricultural exploitation or is part of the obstacle-free space, respectively 50 meters or 30 meters wide, with a carrying capacity the sod on either side of a taxi- or runway. These grass-areas cover about 600 ha. and are the only ones discussed here.

Until 1972 the cut grass from these areas was used in grass-drying plant. After 1972 the grass has not been used anymore, but left where it was. Until 1976 it was cut by cage-mowers (seven-fold), after this year mowing is done by clapper-mowers.

Nature of soil, of humus and drainage

Nature of soil

The aims of control, flight safety (obstacle-free, some carrying capacity and as little bird-attractive as possible) and minimalizing of maintenance time and costs are fixed.

The control measures are strongly determined by the underground of the fields.

In general it can be said that the fields consist of sea-clay and were originally used as arable land, later on as pasture land. These long periods have left a clearly distinguishable humus-layer.

The depth of this layer lies between 0.20 - 0.25 meters minus groundlevel. The ground chart shows in general two lutumclasses and two organic substance classes.

The lutumclasses can be divided into:

I between 5 and 12%

II between 12 and about 25%

The organic substance classes can roughly be divided into:

a. 1 - 2%

b. 3 - 4%

There is no relation between organic substance classes and lutumcontents.

In carrying out control measures no difference is being made.

Drainage

The degree of drainage of the Schiphol areas is determined by the following criteria.

The runways and other pavements, a complex of layers of a thickness of 70 cm (sandwich construction) have to stay above the watertable.

The grassfields (strips along the runways) must have sufficient carrying capacity, surface water and/or very wet furrow attract birds.

Beside these there are the agricultural requirements which have the lowest priority.

Nevertheless the latest requirements are so heavy that they outdo the previous requirements concerning drainage limits. To get sufficient safety the entire Schiphol-area has been drained at a distance of 10 m' centre to centre at a depth of about 1.10 meters minus average ground level.

The most complex drainage system drains into the surrounding ditches via the sewers of the surface water draining system of the pavements. These ditches are part of the general draining system of the Haarlemmermeer Polder Board. They also function as dividing lines between the airfield and properties of third parties.

The situation of the pumping station Lijnden ensures a correct draining during the winter.

The summerlevel is sufficiently low to keep the paved constructions dry.

Sowing, growing process, rough manurial situation, re-sowing

Sowing

As mentioned before all Schiphol-grounds were once arable land. The transformation into pasture land always happened by means of sowing of a lasting grass-seed mixed with a low percentage of clover. The last stage of such sowing took place in 1969.

Process of vegetation

In 1980 a vegetation survey was carried out in order to have a certain zero line and to keep track of the current composition of plantspecies after the re-sowing with a BG 5 mixture, in the course of at least ten years.

We should also remark that only once every two or three years a slightly selective weed-killing has been done, mainly against creeping-thistle (*Cirsium arvense*) and dandelion (*Taraxacum officinale*).

Fertilizers have only been used in an average amount of 100 kg/ha. mixed manure, 15 - 15 - 15 per ha., every two or three years.

Roughly this vegetation survey showed the following:

The following grasses, or combination of grasses are occasionally dominant: Common bent (*Agrostis stolonifera*), Perennial rye grass (*Lolium perenne*), Cock's foot (*Dactylis glomerata*), Smooth stalked meadow grass (*Poa pratense*) and Meadow fescue (*Festuca pratense* Huds)

Couch grass (*Agropyron repens*) is dominant in many places (60%)

Dominating herbs are: Logweed (*Heracleum sphondylium* L), Yarrow (*Achillea millefolium*) and Alehoof (*Glechoma nederacea* L).

Along pavements and arable land we find deviating vegetations matching the surroundings. We leave these out of consideration.

On the whole appr. 45 different kinds of grasses and herbs were found in this survey.

The survey also shows that a sod-composition is found which fits in with its moderately rich, moderately humid environment.

The existing of Perrenial rye grass (*Lolium perenne*) is because of resowing excersises of damaged areas. The dominance of couch grass (*Agropyron repens*) can be the consequence of previous groundwork.

Fertilizing situation

In places where in 1980 resowing of large areas was realized, a valuation was given at the time for a fertilizing situation based on pasture land. This happened roughly according analysis of a number of mixture samples, taken in rather large areas.

In general the evaluation can be stated as follows:

Phosphate	-	low to rather low
Potassium	-	more than sufficient
Lime	-	high
Magnesium	-	sufficient

This evaluation gives, for the time being, in view of the basic pasture-land, no reason to alter the fertilizing situation significantly.

Except when resowing, there is no or hardly any fertilizing done.

Nitrogen is the only fertilizer which is incidentally given to poor spots e.g. after a drought or a severe open winter to liven them up a little.

Nitrogen is used in the form of sulphate of ammonia.

Resowing

It is clear from the aims of maintenance that the grass field must meet the requirements of levelness and carrying capacity.

There should not be any enclosed depths (they attract birds).

The present fields have suffered a severe settling over the years. Beside during activities, frequent interferences in the profile have been made.

Recent and future runway renovations coupled with reinforcements of the surface relief (damage by mowing equipment and vehicles) have made it necessary to effect large scale operations for re-profiling and resowing. Beforehand some important starting points were taken into account.

The resowing was made subordinate to the period in which, from an operational point of view, the technical runway renovation would have to take place. This meant that the times of sowing were not always optimal for sowing. Beforehand it was decided that with all sowing, 50 kgs winterbarley/ha would be used as a cover product.

The soil should be covered as soon as possible in connection with birds and dust. Beside additional sowing of coverproduct a great amount of grass seed was chosen in which Perrenial rye grass should dominate. At the same time a sod with sufficient carrying capacity should come into existence. In theory the original carrying capacity can only be achieved after a span of five years.

An amount of 100 kg/ha, consisting of 70% Perrenial rye grass (*Lolium perenne*) Manhattan and 30% Smooth stalked Meadowgrass (*Poa pratense*) Baron was chosen.

Both selections give a good and comperatively little mass.

As cultivation fertilizer 200 kg mixed manure 15 - 15 - 15 was given.

In view of the sequel of the present grass a quick regrowth of the existing couchgrass was taken into account. Thus, three of the present dominating grasstypes would be back again. This is why other grasstypes have been omitted.

The performance of the operations was done by a specialised firm under our management. The deliverance of grass seeds and fertilizer was done by Schiphol. The work was prosperously accomplished. In general they milled to a depth of 7 cm and twice they used a cultivator to a depth of 50-70 cm. The levelling was done by a special land levelling machine named kilverbak. After that harrowing, dragging, strewing of barley and fertilizer and sowing by a Brillion grass sowing machine.

Levelling is done at sight. Differences in height, if arranged longitudinally to the runway and only slightly sloping, are acceptable. Short kinks are removed. This is to avoid excessive groundwork and removal of humus (with parts of the old sod).

The average price was all in all approx. f 0.60 per m'. VAT and material fracture through debris in the underground excluded. This price is at basic level of 1981.

At this moment an area of approx. 120 ha has been renovated. The results are good. The renovation costs have not been taken into account in the yearly maintenance costs. The remaining areas will be renovated in a period of about five years by resowing.

Present day control and cost-benefit course

Under the present control it turns out that the three requirements: carrying capacity, levelness and attracting as few birds as possible, are still sufficiently met. The two first aims speak for themselves.

The third: 'to attract as few birds as possible' needs some further explanation.

In the period of propeller planes, strikes between birds and planes happened all the time. These were fatal for the birds, while the planes remained undamaged.

With the introduction of the jet-engine it turned out that the air-intake casing and the rotating blades inside were very vulnerable to objects coming in from outside. By this birds are also meant.

In general it is tried to make airports as unattractive to birds as possible. It soon became clear that at many airports among which Schiphol Airport, seagulls and pewits were in 60% (resp. 50% and 10%) the cause of the strikes.

Humid places are very attractive for this kind of birds. This is one of the reasons for drainage and levelling. In addition to this it turned out that these birds prefer short grass, so that they can watch out for enemies and can find food easily.

Long grass hampers the view and the collecting of food. So it was decided to cut the grass at 15 to 20 cm.

The levelness has the constant attention and is maintained by local repair of damages or by renovation.

The carrying capacity of the, on the whole, rather old sod is being demonstrated by the enclosed pictures.

The aircraft was still taxiing on the 50 m' strip and sank into the adjacent farmland (pictures 1-2-3).

The so-called long grass control/long cutting is demonstrated in the pictures 4-5-6.

The working time in case of short cutting of about 15 days a year per runway has been reduced to 6 days a year per runway. The long grass is, as has been shown, the least attractive for birds.

The cultivating of the ground attracts in general many birds, especially seagulls, pewits and oyster-catchers.

The actual long-cutting does not attract birds.

The cost-benefit course is roughly given in the following table (price level 1981).

Period until 1970	rent grassland f 100,-- going down to f	50,-- per ha
1970 - 1972	subsidy to grass-dry costs	f 50,-- per ha
1972 - 1977	average short-cutting costs	f 800,-- per ha
1977 - now	cost of long-mowing	f 200,-- per ha

Weedkilling takes place on the spot or selectively once every two or three years. I would like to put the cost at an average of f 85,-- per ha a year.

The cost of renovation, once every 15 or 20 years, will be for the Division of Great Maintenance of Runways and taxi-tracks. The same holds for drainage and re-drainage.

It goes without saying that we have investigated the possibility of getting profits from cut grass. The grass is of inferior quality and can not be pitted and does not fit into the conduct of business of the Airport or the farmers.

Mowing at a right time for agricultural purposes, before the nesting season in May-June, gives extra bird-nuisance, short grass stables. Haying once might operationally be possible in the months May and June. The profits of about four tons per ha à f 200,-- per ha might be f 800,-- per ha. This means minus cost of harvesting of f 250,-- per ha a nett-profit of about f 500,-- per ha.

Haying is virtually impossible in combination with the dangers of drying and blowing away of hay by jet-engines to these jet-engines. To put a runway out of operation for about ten days to harvest hay under favourable conditions will not be taken into consideration for the time being.

If we act consistently to meet the operational requirements, we can maintain the present maintenance standard, at a price which is reasonable for Schiphol Airport in view of the nature of our soil.

I am, nevertheless, convinced that this is not the last word written about Schiphol-grass.

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N.B. The mentioned photographs could not be reproduced.