DATA PROCESSING IN THE DANISH SUGAR INDUSTRY

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Introduction

For many years, Aktieselskabet De Danske Sukkerfabrikker (DDS) that is, the Danish Sugar Corporation has been responsible for the major part, about 87 per cent, of the production of sugar in Denmark, the remainder coming from a single co-operative society. The Corporation’s production units comprise six beet-sugar factories, one of which has a refinery also, and two juice-stations out in the country. The Corporation’s Head Office and administration are in Copenhagen.

Aktieselskabet De Danske Sukkerfabrikker is a private company, in which the State has no part. Since 1932, however, the Danish sugar-industry has been subject to a concession arrangement with the State, under which the corporation must pay for the beets the price determined by negotiations between the Ministry of Commerce and the beet-growers’ organization and likewise must sell its products at a price determined by the State. In return, the State ensures that the Corporation’s total production costs, including depreciation, are fully covered. Further, the State pays the Corporation for putting the whole of its production apparatus at the disposal of the sugar industry, and secures the Corporation a pre-determined share of the savings accruing as the result of lowering costs of production by rationalization of the operation of the factories.

The Danish System

The total beet area of Denmark, the extent of which is fixed according to the changing possibilities of exporting sugar, was in 1964 about 74,000 hectares, of which about 64,500 are under contract to DDS. These area contracts are made annually.

Basis of Payment:—Such contracts are made with between 20,000 and 22,000 beet growers, and payment is made according to the weight of clean beets and, since 1958, also according to the sugar content of the beets based on the average polarization of the deliveries throughout the campaign of every individual grower. Beets with a polarization of 16.3 to 16.7 are paid for at the standard price, but the individual grower is paid a higher or a lower price, as the polarization of his beets is more or less than from 16.3 to 16.7. Moreover, additional payment is made for early and for late deliveries, while the beet-price is also adjusted for increases in wage-rates. The beet pulp forms part of the beet-price, and is returned free to the growers, who must remove it concurrently with their deliveries.

Delivery.—About 85 per cent of deliveries come by road, about 10 per cent by the Corporation’s narrow-guage railways, and about five per cent by the State’s railways or by sea. The growers must themselves pay the cost of transport, and the Corporation’s expenses, for transport by the narrow-guage railways, State railways and ships are debited in the growers’ accounts.
Allotments — Deliveries proceed according to a delivery plan, which is sent to each grower a week or two before the opening of the campaign. This specifies the total amount the individual grower is to deliver, and the days on which he is to make deliveries. In drawing up this plan, every effort is made to ensure for each grower a uniform distribution of deliveries throughout the campaign. Together with the delivery plan, the grower gets a number of delivery notes stamped with his name, address, and the number of his account.

Procedure at the Factory

Weighing-in the beets at the factories is done exclusively on weighing-machines with dials. Since the introduction of our punched card system in 1954, we have developed, in conjunction with a punched card expert, a punched card and stamping system, which is connected to both the weighing-in and the weighing-out processes for beets and pulp, and also to the sampling process and the measurement of polarization in the tarehouse.

Weighing:—When the lorry loaded with beets is standing on the weighbridge, the driver hands in the delivery note just mentioned. This the weighman puts into the punching and stamping apparatus together with a blank card and a ticket in plastic, upon which there is a six-figure number for identification both printed in figures and punched in code. From the delivery note the weighman then types on the keys of the apparatus the number of the grower’s account, and electrically, automatically, and simultaneously, two things happen:

1. The grower’s delivery note is stamped, and
2. The card is punched to show the number of the account, the number of the plastic ticket, and the gross weight.

When the lorry is weighed out, the delivery note and the card are inserted in the weighing-out apparatus, which stamps and punches the tare weight on delivery note and card, in the same manner as before.

Sampling:—After the lorry has been weighed in, the plastic ticket is returned to the driver, who hands it to the sampler when the latter takes his sample. The ticket then accompanies the sample to the tarehouse, where the number of the ticket is punched in the card together with the weight of the unwashed sample. The punched card then accompanies the sample to the weighing machine for clean beets and to the polarimeter, where these two data are also punched in. All the information needed for accounting for the load has now been collected in two cards.

Pulp:—A similar procedure is followed when the grower takes delivery of the pulp, except that the tare weight obtained on weighing in is used and typed on the apparatus together with the grower’s account number, thus saving a weighing.

The punched cards are sent by all the factories as express parcels on the night trains to Copenhagen for the punched-card department.

Central Bureau

The maintenance of the beet-growers’ accounts on punched cards is done at our Head Office in Copenhagen, on a BULL punched card equipment consisting of:—

1 Electronic computer GAMMA 3 764/64
1 Tabulator BS 72 with sumpunch
Each grower's account shows both quantities and cash, and covers both debits for goods supplied to him in the course of the year—such as beet seed, fertilizer, molasses, etc.—and, during the campaign, daily records of his delivery of beets and reception of pulp, closing with a final statement when he announces that he has finished his deliveries.

Since the beet-price and payment according to sugar-content are fixed beforehand, this is final, without any adjustment after the campaign, and, generally speaking, growers' accounts are closed immediately after the end of the campaign.

The considerable amount of work involved in the accounts with the beet-growers consists mainly in:

1. punching cards according to the delivery notes for beet-seed, fertilizers, molasses, lime-cake etc. (in the months from April to September, this involves about 150,000 cards).
   Before the start of the campaign, a copy is made of each growers' account showing all movements up to that date.

2. The daily reception of beets and delivery of pulp is entered as follows:
   On the basis of the weights shown in the punched cards for beets and pulp and the card for samples and polarization, a beet statement is made out showing—the old balance for dirty beets, clean beets, pol. sugar and beet pulp, specification and calculation of the day's deliveries, and the new balance.
   A new card is punched on the sumpunch showing the new balance. The beet statements, with copy, are made out and sent to the factories daily. One copy is filed at the weighbridge, while the other is sent once a week to the grower.
   Along with the beet statements, the factories are also sent daily a check-list giving the information from the beet and pulp cards and from the sample and polarization cards for each individual grower, listed according to method of transport, and showing the totals of the day's deliveries by each form of transport.

3. Accounting for the beets is done in the following manner.
   The factories send in, along with the beet-card for the last delivery, a "final card", which is included when making out the beet-statement, and at the same time shows by the mark in the balance summary card that the final settlement can now be made. On the basis of the last summary card, a statement card is produced on the reproducer showing beet-deliveries in the various periods, additions or subtractions for sugar-content, carriage charges, etc., and a statement of account is drawn up beginning with the balance at the start of the campaign. The statement of account is sent to the grower together with his cheque.
(4) After the close of the campaign, a final account is drawn up for pulp, and the individual grower's pulp account balance at that date is transferred to the next campaign, so that the grower may begin with a small credit or debit balance.

(5) Similarly, after the campaign, the calculation of various figures is carried out, figures such as those for yields, methods of transport, etc.

Peripheral Hardware

The functions of the various units auxiliary to the computer are worthy of mention.

(1) The Sorter. Sorting the beet punched cards and the sample and polarization cards separately in order of their weighing numbers.

(2) The Reproducer. The beet cards are inserted in the punching channel and the sample cards in the reading channel, and, in one operation,
   (a) the information on weights in the beet card is transferred, for reasons of punching technique, to other fields of the beet card, in which, simultaneously, the figures in the sample card are transferred to the beet card.
   (b) With these two transfers, the following built-in checks operate:
       one to prevent double punching or missed punching in the weight fields, and another to prevent a beet card appearing without the sample card, and vice versa.

(3) The Sorter. The beet punched cards are sorted according to account number, while the sample and polarization cards are translated and returned to the factory for filing. They are used for reference in dealing with any complaint from the growers about sampling or polarization.

(4) The Collator. After the beet cards, sorted into the order of account numbers, balance summary cards are drawn up for the growers' accounts in which there have been changes, and any beet card without a balance summary card is investigated.

(5) The Tabulator. Making out beet and pulp statements, and drawing up new balance summary cards.

(6) The Sorter. The beet cards and the old balance summary cards are separated, and the beet cards are sorted according to method of transport, after which there are three sets of cards:
   (a) old balance summary cards,
   (b) beet cards, and
   (c) new balance summary cards.

(7) The Tabulator. To check the day's deliveries, a check-list is made, producing a summary card for each method of transport. Thereafter, the new summary cards are totalled, as are the old summary cards together with the check-list, and when the two totals are the same, one can be sure that the total of the day's amount of beets received—thus found by two methods—is correct.

Financial settlement for the beets is made, as previously stated, when the grower announces that he has finished his deliveries. The
individual items on the beet account have been both punched in the course of the year in accordance with the delivery notes—such items as beet-seed—and also found on the basis of the last balance summary card. The punched cards for the individual items of the beet account are punched in an account card, while payment items—such as payments for beets in the various delivery periods, where the amounts vary—are punched in account cards on the basis of the last balance summary card. The procedure then is that when the last day of a delivery period is over, the amount of clean beets delivered is transferred to a delivery period card. At the settlement for the beets, this period card forms the basis for the punched account cards for the various periods.

The beet accounts are checked both by adding the balance summary cards for the accounts, and also by sorting and adding up the account cards in order of the text code, where the totals found by these two operations should be the same.

Conclusion

The reception of beets and delivery of pulp daily affects about 4,000 growers' accounts, and covers about 6,500 loads of beets received and about 3,000 loads of pulp delivered.

Besides the beet accounts, nearly all the other administrative spheres are subjected to processing on punched cards, and the capacity of the present equipment is so intensively exploited that it would be inadvisable to subject the equipment to further pressure, while an extension and a more appropriate organization of the functions involved is impracticable. In the light of this situation, the whole organization has been exhaustively examined during the last six months, with a view to changing over to electronic processing of the data involved.

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