CODEN: IBBRAH (5-78) 1-28 (1978)

INSTITUUT VOOR BODEMVRUCHTBAARHEID

RAPPORT 5-78

VERSLAG VAN EEN STUDIEREIS NAAR IERLAND VAN 13 T/M 17 JUNI 1977

door

L.C.N. de la Lande Cremer

1978

Instituut voor Bodemvruchtbaarheid, Oosterweg 92, Haren (Gr.)

Inst. Bodemvruchtbaarheid, Rapp. 5-78 (1978) 28 pp.

INHOUDSOPGAVE

1134(1977)
(100)

Verslag van een studiereis naar Ierland
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Haren (Gr.)

1. Doel van de reis

In verband met het werk voor EEG-project 312 was het nuttig nader kennis te nemen met de produktieomstandigheden in de Ierse landbouw. Tevens werd contact opgenomen met onderzoekers op het gebied van gebruik van dunne mest op grasland.

2. Contacten

Bezocht werden:

a. The agricultural Institute, Research Centre Dunsinea, te Castleknock en het hierbij behorende Grange Station in de buurt van Trins.
contacten met:

D.P. Collins	- animal management dept.
N.E. Downey	- " " "
J.F. Moore	- " " "
M.A. Carrol	- meat research "

b. The agricultural Institute Research Centre Johnstown Castle te Wexford met naaste omgeving.
contacten met:

P.F. Ryan	- adjunct directeur
E. Ryan	- bedrijfsvoorlichter
H. Tunney	- dunne mest onderzoek
J. Lee	- bodemkartering
D. Mc.Grath	- koperonderzoek
M. Sherwood	- afspoelingsonderzoek dunne mest
P. Kiely	- silage kwaliteit i.v.m. dunne mest gebruik
G.A. Flemming	- spoorelementen onderzoek

In gezelschap van de adjunct directeur en de bedrijfsvoorlichter werden enige veehouderijbedrijven (rundvee en varkens) bezocht in de omgeving van Wexford.
Op Johnstwon Castle werd voor de stafleden door mij een korte inleiding gehouden over resultaten van eigen onderzoek met dierlijke meststoffen.

c. Department of Agricultural Engineering van de University College, Upper Marrion avenue, Dublin.
contact met V.A. Dodd over de Ierse maatregelen in verband met de waterverontreiniging.

toen gaan toeleggen op het houden van mestvarkens en kippen met als gevolg dat door de grotere mestproduktie enerzijds en door de steilere hellingen en de ondoorlatendheid van de bodem anderzijds vrij veel afspoeling (runoff) van dunne mest plaatsvond, waardoor in enkele jaren tijds acht van deze midlandmeren eutrofieerden.

Het produktiepeil van de Ierse veehouderij ligt in de orde van grootte van de Nederlandse in de jaren vijftig. Er wordt op weiland maar weinig stikstof gebruikt. Op grasland bestemd voor hooi- of kuilwinning wordt bij een veebezetting van 3 g.v.e. per ha ongeveer 250 kg N per ha gebruikt. De hoeveelheden krachtvoer belopen 100 tot 300 kg per dier en jaar. Op een van de bezochte bedrijven waar een jonge boer met aanmerkelijk grotere hoeveelheden van deze produktiemiddelen werkte evenaarde de melkproduktie het huidige Nederlandse gemiddelde.

Op grond van het karteringsonderzoek vertrouwt men er op door een beter graslandgebruik de veeproduktie meer dan te kunnen verdubbelen, een mening die Collins e.a. onderschrijven. De voorlichter deelde echter mee dat dit intensiferings-proces voorhands nog maar moeizaam verloopt.

Van het rundvee wordt 45% nog in grupstallen gehuisvest en met hooi gevoerd (veestapels met minder dan 20 koeien). De overige worden in ligboxenstallen (cubicles) ondergebracht en met silage gevoerd. Deze ligboxenstallen zijn meestal eenvoudig van opzet (golfplaatijzer) en vaak slechts aan een zijde van een wand voorzien, ook de melklokalen. De vrij hoge wintertemperatuur ($\pm$ 5°C) en lage zomertemperatuur ($\pm$ 15°C) maken deze goedkope bouwtrant mogelijk.

De neerslag is vrij regelmatig over alle maanden verdeeld, 's winters iets meer dan 's zomers.

4. Bemestingsadviezen in de Ierse landbouw

Hieronder volgen enige bemestingsadviezen zoals die door Johnstown Castle te Wexford, het oudste en veelzijdigste centrum voor landbouwkundig onderzoek in de Ierse Republiek, worden gegeven:

a. Weiland

	bij gemiddelde veebezetting	= levend gewicht kg/ha
april - juni	3 g.v.e.	1.500
juli - nov.	1.6 g.v.e.	800
15 jan. - maart	40 - 45 kg/ha N	
aug. - febr.	35 kg/ha P_2O_5 en 70 kg/ha K_2O	(bij P > 4 en K > 75)*
	105 " " "210 " "	(bij P < 4 en K < 75)*

	bij zware veebezetting	= levend gewicht kg/ha
april - mei	2 g.v.e.	1.000
juni - juli	1.5 g.v.e.	750
aug. - nov.	1.1 g.v.e.	550
15 jan. - maart	40 kg/ha N voor vroeg gras	
april - aug.	4 x 40 kg/ha N gedurende deze periode	
aug. - febr.	35 kg/ha P_2O_5 en 70 kg/ha K_2O	(bij P > 4 en K > 75)*
	105 " " "210 " "	(bij P < 4 en K < 75)*

* grenswaarden uitgedrukt in p.p.m. (mg/kg)

b. Hooiwinning

40 kg/ha N, 8 weken voor het hooien
45 kg/ha P_2O_5 en 110 kg/ha K_2O na het hooien in de periode augustus tot februari

c. Kuilvoerwinning

1e snede: 80 kg:ha N, 8 weken voor het maaïen
65 kg/ha P_2O_5 en 145 kg/ha K_2O na het maaien in de periode augustus - februari.

bij 2 sneden:

80 kg/ha N, 8 weken voor het maaien
70 kg/ha N, direct na de 1e snede en
30 kg/ha P_2O_5 en 75 kg/ha K2O; na de laatste snede (periode augustus-februari) nog eens
45 kg/ha P_2O_5 en 110 kg/ha K_2O

Een hoeveelheid van 45 m^3/ha rundvee drijfmest in de herfst of de winter toegediend komt overeen met 15 kg P_2O_5 en 35 kg K_2O, met de N hieruit wordt geen rekening gehouden.

d. Akkerbouwgewassen

	kg/ha N	P_2O_5	K_2O
rooivruchten			
vroege aardappelen	110	250	265
pootaardappelen	40	90	100
consumptieaardappelen	90	210	220
suikerbieten	90	140	180

granen, 1e en 2e jaar na het scheuren van goed grasland

	(bodem P>4 K>50)			(P<4 K<50)		
kg/ha ⟶	N	P_2O_5	K_2O	N	P_2O_5	K_2O
voergerst, z. tarwe	15	35	35	30	45	50
brouwgerst	0	0	0	0	0	0
haver	0	35	35	0	60	60
w. tarwe	30	45	50	30	70	75

indien laag bodem-N (3 jaar e.v. na het scheuren van grasland

	(bodem P>4 K>50)			(P<4 K<50)		
kg/ha ⟶	N	P_2O_5	K_2O	N	P_2O_5	K_2O
voergerst, z. tarwe	45	35	35	42	50	50
brouwgerst	30	30	35	25	60	60
haver	30	30	35	25	60	60
w. tarwe	55	45	50	55	70	75

5. Onderzoek op het gebied van dierlijke mest

Het onderzoek naar de kwaliteit en gebruiksmogelijkheden van dunne mest wordt voornamelijk door Tunney (Wexford) verricht. Deze onderneemt o. a. pogingen om het gebruik van aerometers nieuw leven in te blazen. Met deze methode kan ter plaatse op goedkope wijze een indruk van de chemische samenstelling van vloeibare organische meststoffen worden verkregen, gebaseerd op de relatie tussen soortlijk gewicht en droge stof gehalte van de mest. Deze methode werd tussen 1910 en 1920 door Vogel (Duitsland) ontwikkeld. De aflezingen zijn met nogal grove fouten behept. Men heeft dan ook herhaaldelijk geprobeerd dit apparaat en deze methode te verbeteren. Het tot nu toe beste resultaat werd verkregen door Jouis en Hangard (Frankrijk), die de som van de in de mest aanwezige mineralen relateerden aan het soortlijk gewicht en de droge stofgehalte van de mest. Het zwakke punt van deze veldmethode is, dat er weliswaar een duidelijke correlatie tussen s. g. en droge stofgehalte van de mest bestaat evenals er een duidelijke correlatie bestaat tussen droge stof en mineralen gehalte, maar dat de spreiding van het mineralengehalte bij eenzelfde droge stof waarde zeer groot kan zijn.

Het rundvee wordt 120 tot 140 dagen, in het midden en noorden tot 180 dagen op stal gehouden gedurende de winterperiode, waarbij de volgende mestprodukties ontstaan:

Mestprodukties per dier in ton per 140 staldagen (volgens Tunney)

1 koe, klare mest	3, 2 ton
" , stalmest	5, 5 "
" , drijfmest	6, 4 "
1 vleesstier, 500 kg drijfmest	5, 7 "
1 vleesstier, 250 kg "	3, 2 "
1 mestvarken (per plaats), p. jaar	1, 8 "
100 leghennen, p. jaar	5, 0 "

Als samenstelling van de mest wordt opgegeven:

	ds	kg per 10 ton mest		
	%	N	P	K
stalmest(18n)	20 (13-26)	45(32- 65)	10(8- 17)	68(33-128)
klare mest(16n)	17 (10-23)	33(20- 52)	8(5- 12)	42(30- 60)
rundvee-drijfmest(33n)	8 (1-14)	38(8- 56)	6(1- 12)	42(8- 64)
varkens-drijfmest(25n)	4-5(0, 5-13)	30(4- 70)	9(1- 34)	15(2- 33)
kippe-drijfmest(8n)	24 (20-30)	142(100-170)	51(40- 60)	57(40- 76)
vleeskuikens-mest(8n)	47 (26-76)	256(133-368)	82(39-112)	122(59-200)

In de rundveedrijfmest komt evenals ten onzent ± 50% van de stikstof in ammoniumvorm voor. De werkzaamheid van de stikstof wordt dan ook grotendeels bepaald door de optredende ammoniumverliezen na het spreiden van de mest, en deze weer door de weersomstandigheden aldan en op bouwland de tijdsduur verlopen tussen verspreiden en onderwerken van de mest. Het inspoelen met water van de verspreide mest verhoogt de werking ervan, niet alleen doordat de ammonium-N sneller in de grond terecht komt maar ook door het wegnemen van het bedekkingseffect van de drijfmest dat een negatievere uitwerking (afscherming lichtinval) heeft naarmate meer mest wordt toegediend.

Geadviseerd wordt geen rundveedrijfmest te gebruiken op weilanden of, als men dit toch wil doen deze bemesting minstens vier weken voor het inscharen uit te voeren.

Drijfmest moet over kort gras worden toegediend en minstens 7 weken voor de kuilbereiding. Hoeveelheden tot 45 m^3/ha rundvee- of vleesvarkens drijfmest hadden geen ongunstige invloed op silage kwaliteit en smaak.

Varkensdrijfmest zou verhogend werken op de pH van de bodem (niet onze ervaring in Nederland) en het gehalte aan opneembaar mangaan verminderen.

Volgens Sherwood en Dodd zal maar weinig N en P met afspoeling verloren gaan indien de grond ten tijde van de verspreiding van dunne mest een vochttekort heeft van 12,5 mm of meer en de vochttoevoer via deze mest op ondoorlatende gronden niet hoger is dan 5 mm. Men verwacht dan evenmin P afkomstig van de dunne mest in het drainwater te vinden, maar wel kan er wat meer stikstof in voorkomen. Volgens Dodd bepaalt de balans tussen regenval en evapotranspiratie wat de maximale hydraulische belasting van de grond met drijfmest zal zijn terwijl de maximale belasting met nutrienten samenhangt met de opname hiervan door de verbouwde gewassen.

6. Koper in mest van vleesvarkens

Melding werd gemaakt van een veeljarige proef te Atrim (N. Ierland) waar gedurende drie achtereenvolgende jaren dezelfde schapen werden geweid op gras bemest met hoge giften varkensdrijfmest, in totaal 900 m^3/ha over de proefperiode. Er werd op deze wijze 47 kg Cu via de varkensmest aangevoerd waardoor het Cu-EDTA gehalte van de bodem als volgt steeg (in mg/kg):

	blanco	varkensdrijfmest
0 - 5 cm	18	64
5 - 10 cm	19,5	31
10 - 15 cm	19,5	25

Het Cu-gehalte van het gras was constant te hoog voor de schapen (14 mg/kg op de controle en 50 tot 164 mg/kg, afhankelijk van het tijdstip verlopen na de verspreiding van de mest, in de objecten met varkensdrijfmest. Grote hoeveelheden Cu werden in de schapefaeces gevonden. Uit het bloedonderzoek bleek dat het gehalte aan het glutamine-oxaalzure transaminase van de controle groep schapen maar weinig lager was dan die van de groep op de bemeste velden en dat in deze laatste groep waarden voorkwamen tot 2.000 i.e. van bovengenoemde enzym, aangevende dat de lever van deze dieren sterk werd afgebroken.

Toch stierven er geen schapen aan chronische kopervergiftiging. Men verwacht dan ook geen moeilijkheden wanneer schapen tot 16 kg Cu per ha en jaar opnemen uit grasland bemest met varkensdrijfmest. Een verklaring voor dit opmerkelijk proefresultaat dat indruist tegen de bestaande waarnemingen en meningen werd niet gegeven.

Dit resultaat is des te opmerkelijker omdat onder praktijkomstandigheden schapen nooit zo lang achtereen op hetzelfde grasland worden geweid. Men veronderstelt dat de opgenomen hoeveelheden grond en molybdeen, mogelijk ook fosfor, het koper slecht opneembaar maakte voor de dieren waardoor het niet lethaal werkte (onderzoek van Suttle e.a. te Edinburg).

In Wexford is Dave Mc Grath thans bezig met proeven over grondopname door schapen en de invloed van Cu (± 700 mg/kg droge mest)en Zn (± 800 mg/kg droge mest) uit de mest van vleesvarkens op de Cu- en Zn-huishouding van de grond, de opname door het gras, de besmetting van buitenaf (mestdeeltjes, opspattende grond), de opname door en de gezondheid van de schapen.

7. Cobalt en Selenium

In sommige streken van Ierland komt Co-tekort voor (Fleming). De opname van Cobalt is goed bij lage Mn-waarden en slecht bij hoge. Ook de pH is van invloed.

Voorts komen in bepaalde gebieden opduikingen voor van organisch materiaal ("Namurian Shales" uit het midden carboon), rijk aan allerhande micro-elementen, waaronder Selenium. Deze opduikende koppen kunnen nogal problematisch zijn in verband met vergiftigingsverschijnselen bij het vee in droge jaren.

8. Mestinjectie op grasland

Volgens ontvangen mededelingen heeft Alfa Laval mestinjecteurs voor gebruik op grasland in de handel, die o.m. in Denemarken en Finland worden gebruikt.

9. Verspreiding van en de parasieten door dunne mest

Downey en Moore (Dunsinea, Grange) zijn van mening dat er serieuze kansen ontstaan op de verbreiding van longworm, leverbot en darmparasieten bij rundvee wanneer intensief gebruik wordt gemaakt van dunne mest op weilanden. Bij infectieproeven met jongvee bleek een jaar na de kunstmatige infectie via bemesting met dunne mest in de geïnfecteerde groep 300 wormen voor te komen tegen slechts 50 in de controle groep.

Deze parasieten zijn in dunne mest opslagplaatsen te vinden tot ± 33 cm beneden de mestspiegel. Aeratie en/of temperatuurverhoging kunnen decimerend werken. De pH heeft geen invloed. Een bewaringsduur van de mest van meer dan 4 à 5 maanden gedurende de winter of 3 tot 5 maanden gedurende de zomer vermindert de infectiekansen.

Moore past voor het verzamelen van deze parasieten dezelfde vangmethoden toe als in gebruik bij het nematodenonderzoek.

10. Fosfaatbemestingsproef op grasland dat permanent wordt gemaaid ten behoeve van de winning van kuilvoer

Deze proef startte in Grange in 1967. Tot 1972 was er in totaal 0, 30, 60, 80, 120 en 240 kg P per ha toegediend. Er was nadien een duidelijke nawerking van de gegeven P-bemesting, van 13 tot 27% beter dan onbemest. Deze nawerking was het duidelijkst waarneembaar in de eerste snede. De nawerking vermindert thans evenwel tengevolge van de teruglopende P-toestand van de grond.

11. Verbetering van de zode van een versleten weiland

Vergeleken werden een oude- en een nieuwe zode van een weiland. De eerste bestond hoofdzakelijk uit Agrostis en Poa Trivialis, de tweede uit Lolium Perenne en Poa Trivialis. De vier behandelingen waren:
- onbehandeld
- gedeeltelijke vernietiging van de zode met 0, 7 l/ha paraquat en door zaaien met de Bettinson zaaimachine
- volledige vernietiging van de zode met 5, 6 l/ha paraquat en herinzaai met de Bettinson zaaimachine
- als vorige + bemesting met 18 t/ha rundvee drijfmest

De behandelingen uitgevoerd in augustus 1974 resulteerden in de volgende botanische samenstellingen in januari 1976 (%):

	Lol. Perenne		Poa Triv.		Agrostis		Diversen	
	OZ*	NZ*	OZ	NZ	OZ	NZ	OZ	NZ
blanco	6	33	8	51	72	13	14	3
doorzaai	24	64	17	31	54	3	5	2
herinzaai	35	43	20	35	36	10	9	12
herinzaai + drijfmest	14	31	40	25	41	41	5	4

* OZ = oude zode, NZ = nieuwe zode

In de oude zode werd de vestiging van Lolium Perenne het meest bevorderd door de zode eerst te vernietigen, in de nieuwe zode was doorzaaien daarentegen beter.

Poa Trivialis nam bij alle behandelingen van de oude zode duidelijk toe, maar deze werkten negatief in de nieuwe zode.

Zowel in de oude als de nieuwe zode daalde het aandeel van Agrostis, met uitzondering van het object met drijfmest op de nieuwe zode waar het Agrostis bestand duidelijk toenam.

Het gebruik van drijfmest vermeerderde weliswaar het aandeel van Lolium Perenne in de oude zode met liefst 130%, maar dit bleef ver achter bij dat in de nieuwe zode. Volgens Collins kwam dit overeen met eerder gevonden resultaten bij gebruik van drijfmest.

12. Roostervloeren versus vaste vloeren in stallen met vleesstieren

Volgens Carroll (Dunsinea) meent men in Ierland dat vaste stalvloeren met stro als ligstrooisel resulteren in een hoger eindgewicht bij vleesstieren. Er zou in 240 dagen tijds een significant verschil zijn gevonden van 16 kg per dier ten gunste van de proefgroep in de stallen met vaste vloeren met strobedekking.

13. Stikstofreactie van grasland onder droogte omstandigheden

In tijden van droogte werd geen reactie van het gras gevonden op de gegeven stikstofbemesting, noch qua kleurverschillen, noch qua hergroeisnelheid, wanneer er weer voldoende vocht beschikbaar kwam (Collins). In tegenstelling tot het advies in Nederland acht men het dus niet zinvol enige stikstof te blijven strooien bij aanhoudende droogte.

14. Veestallen

Van het rundvee wordt 45% nog in grupstallen gehuisvest en 55% (meest veestapels van meer dan 20 dieren) in ligboxenstallen (cubicles). Vanwege de vrij gunstige climatologische omstandigheden worden deze meestal zeer eenvoudig van opzet gehouden (zie bijlagen 1 t/m 3). Dodd wijst in dit verband ook op de verschillen in belasting van het milieu met afvalprodukten, met name met afvalwater, door de verschillende staltypen en hun bijbehorende voorzieningen (erven, e.d.). Hij berekende voor een aantal van 100 vleesstieren de volgende hoeveelheden afvalwater en mest die per bedrijf moeten worden verwerkt:

	oppervlakte in m^2			hoev. mest	hoev. dakwater bij		hoev. vervuild water van het erf bij	
	tot.	overdekte	open	in 150 d.	500 mm*	760 mm*	500 mm*	760 mm*
ligboxenstal	1542	372	1170	506	187	281	590	884
niet overdekte ligboxenstal	1542	-	1542	506	-	-	777	1165
loopstal met strooisel	1542	372	1170	506	187	281	590	884
loopstal met roostervloer	715	260	455	506	360	540	-	-

* regenval gedurende de winter

In niet overdekte ligboxenruimten wordt ruim tweemaal zoveel vervuild erfwater (met BOD_5 van 1200 mg/l) geproduceerd als mest. Het andere uiterste vormt de loopstal met roostervloer waar praktisch geen vuil water van het erf afspoelt en de verwerking van de dierlijke afvalprodukten de minste problemen oplevert.

15. Wettelijke maatregelen, voorschriften en subsidies in verband met de bescherming van het milieu

Het voorkomen van vervuiling van de openbare wateren en het regelen van allerhande andere zaken die hiermede op de een of andere wijze samenhangen wordt geregeld in de "Local Government (Water Pollution) Bill" van 30 juni 1976.

In het hierna volgende (p. 11) artikel van L. Mannion "Government Grants and Regulations for Storage" wordt nader ingegaan op de subsidiemogelijkheden voor de bouw van mestvaalten, gierkelders en opslagplaatsen voor vloeibare dierlijke meststoffen, alsmede de voorschriften die hierbij van toepassing zijn.

Government Grants and Regulations for Storage - L Mannion, Department of Agriculture, Ireland 1977

Grants

Grant-aid towards the provision of storage facilities for animal manures is available under the Farm Modernisation Scheme to all farmers eligible to participate in the Scheme. Such facilities are classed as fixed assets under the Scheme. The level of aid depends primarily on the category of the farmer. For development farmers outside the Disadvantaged Areas and for the category designated "other farmers" in all areas (provided they are not eligible for a retirement pension) it consists of a capital grant not exceeding 30% of the approved cost or 5% interest subsidy for a period of up to 15 years. For development farmers in the Disadvantaged Areas, viz. the areas designated under the EEC Directive 208/75, the aid now payable for manure storage facilities in common with other works classified as farm buildings for the purposes of the Scheme is a capital grant equivalent to 40% of the approved cost. For commercial farmers in all areas and for farmers in the category "other farmers" who are eligible for retirement pension the level of aid is a capital grant not exceeding 20% of the approved cost or 3% interest subsidy for a period of up to 15 years. The manure storage items at present eligible for aid are slurry tanks, dungsteads and liquid tanks but the list in this connection is subject to periodic review.

In addition to grant-aid for storage facilities, aid is also available under the Scheme to all categories of farmers towards the provision of facilities used in connection with the handling of animal manures and which can be classed as fixed equipment. The items of this type eligible at present are pumps for slurry handling and for washing water disposal. The level of aid available to the different categories of farmers in respect of such fixed assets is as stated above for storage facilities except that the higher rate of grant available to development farmers in the Disadvantaged Areas in respect of storage facilities does not apply to these items.

In the case of development farmers aid in respect of investment in mobile equipment is also available. This consists in all cases of a capital grant of not more than 10% or 5% interest subsidy for a period of up to 5 years. The items currently eligible under this heading which are used in connection with animal manure handling and disposal are slurry tankers, mounted slurry scrapers, slurry sweeps, slurry and dung spreaders and tractor-mounted agitators.

Farm Development Plan: It is a condition of the Farm Modernisation Scheme that in the case of development farmers no grant-aid is payable in respect of any investment (the various investments above included) unless the investment is provided for in an approved farm plan.

Avoidance of Pollution: It is a general condition of the Farm Modernisation Scheme applicable to all categories of farmers that for certain works regarded as a likely source of pollution approval of aid will be conditional on the beneficiary taking all reasonable steps to guard against pollutant

effects. In this connection the official approvals issued to applicants by the Farm Development Service of the Department stipulate that payment of grant aid will at all times be subject to compliance with the conditions of the Farm Modernization Scheme and with specified (additional) conditions one of which in the form of approval currently in use is that the location or site of any building, construction or installation and the arrangements for effluent collection, storage and disposal therefrom shall meet such specific conditions as the Minister may prescribe.

Application of Guidelines on Pollution Control

The approach adopted in laying down anti-pollution conditions is that circumstances of each farm situation require to be considered individually. The aim is to ensure that the conditions prescribed in each case are suited to the praticular circumstances involved and that they are both adequate and practical as pollution control measures. Since circumstances usually vary considerably from case to case it is felt that it would be impracticable to adopt a general or standard set of conditions which would apply universally. What is being done instead is to set the basis for the application of uniform guidelines to be followed by field officers in their task of ensuring the adoption of the most appropriate and effective control measures in the different circumstances likely to be encountered by them at farm level. For certain works, however, a mandatory minimum standard for grant-earning purposes is set for general application and/or for limited application within a prescribed area, e.g. slurry storage capacity for piggeries in the catchment area of Lough Sheelin.

In accordance with a new set of comprehensive guidelines proposed to be issued at an early date it is intended that in future in the case of every application for grant aid under the FMS in respect of works in or around a farmyard complex, the application will be considered from a pollution point of view not only on its merits but also in conjunction with and and relation to the waste handling and disposal arrangements on the site as a whole. In every case where it is considered that the arrangements for existing animal buildings or other waste-producing structures such as self-feed silos are unsatisfactory the applicant will be encouraged to include the provision of an adequate system of waste storage and disposal as part of his current proposal for grant-earning purposes. This procedure is considered to be in the best interests of the farmer especially now with the coming into operation of the recently enacted legislation on water pollution.

The guidelines emphasise the critical importance of careful siting of all waste-producing structures including animal houses and auxiliary manure storage facilities having regard to local topography, proximity to water resources and to dwellings and other non-agricultural property, drainage characteristics of the local soil and direction of the prevailing wind. A section is included on "Animal Manures and Air Pollution" it being pointed out that as intensive livestock units and particularly pig and poultry enterprises increase in number and size the problem of odour nuisance will become more acute making it more necessary than hitherto to take precautions against this form of pollution.

It is recommended that the minimum distance separating a large scale intensive pig or poultry production unit from the nearest built-up area or group of dwellings should normally be not less than 500 metres but that the circumstances of each individual case should be taken into account.

In all matters relating to pollution control conditions including the siting of proposed animal buildings and the provision of adequate manure storage facilities the local officers of the Farm Development Service are advised to maintain close liaison with the local agricultural advisers.

Length of Storage Period for Animal Manures

The general recommendation in the guidelines regarding the crucial factor of the length of storage period that should be provided for is that under our climatic conditions it is desirable to provide storage for most of the winter period for manures in slurry form.

A four-month (16 weeks) winter storage period is suggested as the minimum that should be provided for in most farm situations throughout the country and it is recommended that the slurry storage capacity to be prescribed as a grant-earning condition in any particular case should normally be sufficient to provide storage for all the slurry produced at the site over this length of storage period at least. It is realised that in the past the norm generally adopted in this respect in most areas was probably three rather than four months except in the case of fattening pigs where the standard applied (20 cu. ft. per pig place) does correspond to a four-month storage period.

A five-month (20 weeks) period is recommended in situations where there is any obvious risk of pollution likely to arise through run-off from the land spreading of the slurry. It is considered that by thus extending the storage period in such situations a chance will be given to the soil to dry out sufficiently to increase its capacity to retain the applied slurry. At the same time the rate of evapotranspiration of the water fraction of the applied slurry is increased and the direct pollution risks associated with heavy precipitation following spreading are diminished. It is intended that this length of period will apply generally to situations or areas with impervious soils with or without field drainage systems, sloping land, high winter rainfall and especially to all areas in the vicinity of watercourses.

In the colder parts of the country with very high rainfall and a later start in the growing season and particularly in inland lake catchment areas with poorly drained peaty or gley soils and in areas generally where the risk of water pollution from the land spreading of slurry is known to be acute, the guideline is that up to six months' storage at least requires to be provided for.

In the catchment area of Lough Sheelin the recommended period of storage in the case of pig production units is eight months to cater for the period extending from mid-August to mid-April and this is now invariably adopted and applied in estimating the minimum slurry storage capacity to be provided for in this particular catchment area.

Storage Design Criteria

In relation to the storage design to be adopted in any particular farm situation the guidelines lay it down that unless the existing manure storage facilities are adequate and satisfactory, the design should be of sufficient capacity to hold all the manures currently produced on the entire site, as well as any manures arising from farm building or other development proposals currently planned for the site as a whole, for the minimum length of storage period recommended in the particular case.

To enable estimates to be made of manure production, typical figures for the different classes of farm animals are quoted in the guidelines but it is pointed out that they may require to be modified in the light of individual circumstances.

It is made clear that in calculating the size of storage tank required in any particular case the amount of water allowed to mix with the manure, for instance as rain falling into uncovered storage tanks, should be taken into account as otherwise the calculation may present a serious under-estimate of the actual storage capacity required. In this connection certain figures are quoted as a guide in estimating the additional storage capacity that should be allowed for in respect of rain-water in the case of uncovered storage tanks of different typical depths and also in the case of a typical-sized topless cubicle layout. The additional storage requirement in respect of the cubicle area on its own in the latter instance can work out as high as 40% depending on rainfall and length of storage period. In view of the extent to which run-off from the cubicle area is liable to be contaminated by contact with animal excreta it is recommended that it should, preferably, be collected in the manure storage tank rather than in a yard run-off tank.

Other Guidelines on Collection and Storage

Other relevant considerations are requirements relating to the collection and storage of manure that are specifically covered in the guidelines are as follows:

(1) The need for ensuring that underground slurry tanks are constructed only on sites with good drainage and sufficiently low ground water levels is spelled out. It is pointed out that in poorly drained sites or in conditions otherwise where the ground-water level is periodically higher than the invert level of the tank, the tank is liable to collapse and unless special precautions are taken to ensure water tightness there is a danger that ground-water will seep into the tank through the walls and/or floor thus endangering an over-flow of the slurry at some stage. It is recommended that if in any particular farmyard situation a properly drained site suitably located is not available consideration should be given to installing an overground rather than an underground tank. It is stressed that in either case it is most essential that the tank be water-tight from the point of view of pollution control.

(2) The need in the case of a dungstead to provide a complementary effluent tank to hold seepage from the dungstead is stressed. It is suggested that such seepage should be trapped by means of a perimeter channel and conveyed into the effluent tank. If a tank for the collection of yard run-off and possibly silage effluent is available on the site, such tank although of limited capacity would be acceptable for the collection of seepage also from the dungstead provided that suitable facilities are available on the farm for the safe disposal of the contents by irrigation to land on a regular basis.

(3) A method of calculating the capacity of dungstead required in any particular case is indicated and on the basis of this it is shown as a guide that minimum floor area of dungstead required to accomodate the manure production from 508 kg (10 cwt.) beef cattle would be 0.08 m^2 per week per animal which is equivalent to 1.28 sq. metres (say 14 sq. ft.) per animal for a 16-week storage period or 1.60 sq. metres (say 17 sq. ft.) for a 20-week storage period. The corresponding figures for dairy cow of 560 kg. (11 cwt.) body weight are shown to work out at 0.12 m^2 per week per cow or 1.92 sq. metres (say 21 sq. ft.) per cow for 16 weeks' and 2.4 sq. metres (say 26 sq. ft.) per cow for 20 weeks' storage.

(4) It is indicated that in pig units where the slurry is collected in channels located under slatted dunging areas from which it is self emptying to a storage tank, the space provided by the channels is acceptable in part as meeting storage capacity requirement and accordingly may be taken into account in calculating the size of storage tank required.

(5) It is particulary stressed that tanks and dungsteads for the storage of slurry and also tanks for the storage of liquid manure should as a rule be completely emptied (by land application of the slurry) in the late Autumn or early Winter - say mid-November at the latest, viz. just before commencement of the Winter storage period, in order to avoid over-flows and possible pollution before the next land application of slurry would normally be due to be carried out in the following Spring.

(6) Attention is directed to the need for collecting or otherwise containing liquid manure in the case of partially bedded conventional type animal houses such as tie-up byres and certain types of piggeries where there is but little absorption of the liquid fraction. It is pointed out that in these cases suitable provision should be made for the containment of the liquid portion - for instance by channelling it into a liquid manure tank where this is warranted by the volume involved. It is emphasised that whatever arrangements are made for dealing with the liquid manure and associated run-off in such circumstances, precautions should be taken in all cases to ensure that no liquid effluent is allowed to seep into open ditches or drains or otherwise to reach a watercourse.

(7) Attention is also directed to the need for storing solid farmyard manure produced by the more traditional methods of housing farm animals in soundly constructed pits with impervious floor and either walls or a suitable kerb to contain any liquid seepage. It is stressed that farmyard manure should in no case be stored in a manure heap either in or around the farmyard or in fields along the banks of streams or elsewhere on the farm apart from such property constructed water-tight pit. It is suggested that a manure pit should normally provide storage for a period of six month at least and certain data are quoted as a rough guide with a view to enabling the size of structure required in any particular circumstances to be estimated.

In the above connection it is relevant to note, in the context of applying controls over the manner in which polluting matter is handled or stored, that the Local Government (Water Pollution) Act which has just been passed empowers local authorities to serve a notice on any person having custody of polluting matter on his premises. This notice may specify the measures necessary to prevent such matter from entering waters and the period within which such measures are to be taken.

Collection and Disposal of Yard Run-off

It is recognised that the run-off from all buildings layouts for cattle involving roofless structures, open loose yards and self-feed silos or silage areas consists of a relatively highly polluted effluent which can be a major source of water pollution and therfore requires to be managed with due care. As the additional volume of dilution water which it contains renders it impracticable and uneconomic to collect such effluent in the same tank as neat slurry it normally requires to be handled and stored separately.

The general recommendation is that all such yard run-off should be discharged into a properly constructed collecting tank for disposal by irrigation to land. Under no circumstances should it be allowed to discharge into open ditches or other watercourses or to flow unchecked over the farmyard surface or over an adjoining field or paddock as has sometimes happened in the past. It is not considered that the practice of direct disposal by gravity flow on to nearby fields should be generally recommended owing both to the water pollution risk that this may involve in certain situations and to the liability of seriously harming soil structure.

A tank of limited capacity is sufficient and acceptable in all cases as it will be for short-term storage only. The guidelines proposed for general adoption as minimum standards in respect of tank capacity are:

(1) For tanks which form part of a direct irrigation system whether by means of an automatically operated pump or a pump operated by manual control switch - 1-inch of run-off from the total open-yard catchment area involved, and
(2) For tanks which are not to be serviced by a direct irrigation system - 2-inches of run-off from the total open-yard catchment area.

The rationale in relation to the above 1-inch standard is that although, theoretically, the tank capacity required in the case of an auto-controlled system would need to be only minimal provided the pump has sufficient capacity and is kept in good working order, nevertheless it is desirable to aim at providing a reasonable margin of safety even in the case of such pumps in order to cater for the eventuality of the pump's breaking down periodically or for other eventhualities which might render it necessary temporarily to disconnect the system.

It is estimated that in the case of an average size dairy herd housed on the cubicle system with covered cubicles and open self-feed silo and taking the floor area occupied by the dungstead into account as well as the assembly yard, the exercise yard and the area occupied by the open silos, the 1-inch of run-off standard when applied to the total open surface area likely to be involved would correspond to as much as 60 gallons (min.) of effluent per cow.

It is further estimated that by taking account of such factors as slurry seepage from the dungstead and silage effluent seepage, as may be appropriate depending on the season of the year, in addition to the volume of runn-off generated by the milk unit washings and by rain-water falling on the catchment area from a rainfall equivalent to 1-inch per week, a tank based on the standard mentioned should be capable of catering for the total run-off likely to arise under average conditions in the layout under consideration over a period of 2 to $2\frac{1}{2}$ days and it is felt that this would normally provide a sufficient margin of safety, as referred to above, for direct irrigation systems whether automatically or manually controlled.

As regards the 2-inches of run-off standard proposed for methods of disposal based on systems other than direct irrigation, e.g. a vacuum tanker operated by either the farmer himself or by a contractor, the question that arises here relates to the frequency of emptying of the tank, viz. what length of interval between successive emptyings is to be regarded as reasonable bearing in mind the risk of overflowing if the interval required is unduly short. The standard of 2-inches of run-off would - on the same basis of computation as that outlined above - only provide for the amount of effluent from all sources likely to arise in one week (or less), and it is felt one emptying per week is the maximum frequency that any farmer would be likely to favour or to adopt in practice. This would apply all the more in circumstances where the emptying and land application are to be carried out by a contractor. Another consideration that arises in this connection is the risk that it may not always be possible owing to soil conditions for the loaded vehicles concerned to travel the land.

It needs to be emphasised if water pollution risk is to be avoided that whichever of the above methods of land disposal of run-off is to be adopted, success will depend very largely on the proper management and operation of it in practice and it is felt that this aspect is more critical than the actual size of tank; for example, a number of fields should be used in rotation if at all possible; application near water-courses, open drains and in the region of field drainage systems should be avoided; yard surfaces will need to be scraped thoroughly each time

so as to remove as much as possible of the neat slurry into the dungstead thus minimising the pollutional strength of the effluent that remains. In the case of an irrigation system the distribution hose and sprinkler require to be changed regularly to fresh areas if saturation of the soil and surface run-off are to be avoided. Factors of importance in relation to the pump to be installed in such a system are its suitability to deal with the type of effluent in question, its capacity and relability, the correct positioning of it in relation to the tank and the maintenance of it in good working order at all times. The physical conditions on the site including the head against which it has to operate must also be taken into account when selecting the pump.

Limitations of Irrigation Method of Disposal

Although as stated above the general recommendation for disposing of the large volumes of liquid waste which yard run-off entails is by tank collection and irrigation to land, it is realized that this method of disposal can give rise to its own pollution problems in certain farm situations. For instance it involves a risk of water pollution in areas with fissued rock formation particularly where the rock is near the surface and the soil covering is shallow as frequently occurs where the soil is derived from carboniferous limestone rock as distinct from carboniferous drift. In circumstances where the run-off contains seepage from the dungstead and/or silage effluent the risk of pollution in such areas is significant and it is greatly increased if the irrigation system is not carefully operated so as to avoid saturation of the soil and the creation of pools of effluent. It is usual to receive quite a number of reports each year of pollution of underground water resources by silage effluent from areas with shallow soils of the type referred to. Owing to the above limitations of the irrigation method in relation to areas with soils of the type described it is considered that the method is not suitable for general application in such areas.

It is suggested in this connection that experimental work on alternative methods of disposal possibly involving some treatment of the effluent may be warranted. The barrier or sedimentation ditch system as reported in the British Ministry Short Term Leaflet 172 would seem to be cheap and promising for some farm situations. Apparently the aim of the system is to make run-off effluent acceptable for discharge into a watercourse or a public sewer. For this reason the system may have relevance also in the context of the new water pollution control legislation.

Soakaways

There is some controversy as to whether a soakaway should be accepted in any circumstances as a method of disposal of any type of farmyard liquid effluent. It has serious limitations from the point of view of water pollution risk and for this reason it is considered that it should certainly not be generally recommended. This method can only be used if the water-table is below the bottom of the soakaway and the soil und underlying strata are such that the effluent concerned will not impinge directly on surface drainage water or seep into cracks, fissures or field drains

or percolate into wells or other ground water supplies. While a soakaway may under special conditions be effective for a time there is always a risk that it will become ineffective with usage due to clogging or saturation of the subsoil. Pollution of underground water can occur due to the latter cause even after the soakaway has given years of satisfactory performance. The only circumstances where it may possibly be considered acceptable is where very limited quantities only of effluent are involved and then only when it is certain that there is no danger of polluting watercourses, wells or underground water supplies in the vincinity. The soakaway should under no circumstances be used in areas with fissured rock such as carboniferous limestone.

Anaerobic Lagoons

A system for the storage of farmyard slurry and other farm liquid wastes which has been of interest for some time back is that of the anaerobic lagoon. This sytem also is attended with controversy as to whether it is a safe system from a water pollution point of view. Owing to the process of anaerobic decomposition which sets in when slurry or other organic waste is stored in excavation ponds or open lagoons, large quantities of offensive smelling gases such as hydrogen sulphide are produced and this is an additional objectionable feature of the lagoon system. The problems of siting and construction thus associated with lagoons in the context of water and air pollution prevention as well as those of their general unsightliness and the possible health hazards associated with them are such that it is felt that they cannot as of the present at least be generally recommended or accepted.

There may, however, exceptionally, be special soil conditions or isolated locations where acceptance of a lagoon may be warranted as providing a suitable effluent storage container. Such locations, for instance, would require to be far enough away from neighbours' dwellings and other non-agricultural property and from public roads, etc., so that the lagoon will not cause a nuisance in the area. To protect against ground water pollution by percolation of effluent, the soil and subsoil would require to be of an impervious nature in order to give watertight conditions in the lagoon. It is stipulated that if any permeable or porous layers are encountered in the excavation the lagoon should be sealed with an impervious lining. Areas with shallow soils or subsoils or areas where fissured rock approaches the surface should not, it is felt, be considered nor should areas where the water-table is such that it would be appreciably above the bottom of the lagoon. Areas of high rainfall in general are ruled out as unsuitable. It is suggested that the contour of the area would require to be such that the lagoon could be sited so as to avoid risk of pollution of surface or drainage waters in the event of an overflow or accidental leakage and at the same time so as to exclude the possibility of surface drainage entering the lagoon from adjacent areas.

Even if, exceptionally as stated above, a particular lagoon is considered suitable and acceptable for the purpose of enabling an associated waste-producing structure to qualify for grant aid no such aid is payable up to the present time at least towards the excavation or construction of the lagoon itself.

Farm Buildings and Planning Control

New regulations under the Local Government Planning and Development Acts have come into operation as from 15th March which bring intensive animal production units under the planning control process. To give effect to this Class 6 of Part III of the Schedule to the previous regulations (1967) has been replaced by three Classes, viz. 7, 8 and 9. (See extract from S.I. No. 65 of 1977 attached)* It will be seen from this that the threshold size above which planning permission is necessary is 400 square metres and that open loose yards and self feed silage areas, etc. are to be taken into account in computing to threshold. The main implication of the amendment as far as the farmerons concerned is that enterprises of the size covered will now require planning permission from the local planning authorities.

Under the previous regulations made in 1965 and in 1967 farm buildings were exempt from planning control provided, inter alia, they were sited not less than 30 feet from a public road and subject in certain cases to not being within 100 feet of any dwelling house, or not being more than 21 feet high if within 100 yards of a public road.

The main purpose of the amendment now introduced is to secure a measure of control over pollution from the larger and more intensive farm building units used for the housing of livestock. However, this will only be achieved if adequate control measures that are both reasonable and practical, and suited to the different circumstances of each individual case are specified in conditions to be attached to the planning permissions. There conditions would require to be specific in relation to such matters, for example, as the following:

(a) Siting of the proposed structure(s) having regard to the various factors mentioned above which affect choice in this matter;

(b) Type and capacity of effluent storage tanks that must be provided depending not alone on class of animals and actual size of the proposed enterprise but also on the frequency with which land spreading can safely be carried out, and this as has been indicated above depends largely in turn on local hydrological factors and soil conditions;

(c) Arrangements where necessary that require to be entered into and followed through in regard to the land disposal of effluent - involving an assessment of land area (and its suitability) on the operators own holding or available on a spreading agreement basis on neighbouring farm(s).

It is envisaged that the closest liaison, consultation and co-operation will be established between the Department of Local Government and the local planning authorities on the one hand and the Department of Agriculture including the Farm Development Service and the local

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* blz. 22 e.v.

advisory services on the other in order to achieve a harmonised approach to the implementation of the new planning regulations in relation to farm buildings. It will be evident, for example, that the anti-pollution conditions to be attached to planning permission in each individual case will require to parallel those attached to the grant approval issued by the Farm Development Service in the same case. The Department of Agriculture, while itself open to the reception of ideas and advice in the matter at all times, would regard itself as the competent body to advise the Department of Local Government and the planning authorities about the appropriate conditions to be specified in individual cases.

It is suggested that there is a wider need generally for a more harmonised approach in this sensitive area of pollution control from farm waters on the part of all bodies who are involved on work impinging on this field.

Extract from Statutory Instrument no. 65 of 1977.
The Local Government (Planning and Development) Regulations, 1977.

Part III - (continued)

Column 1 Description of Development	Column 2 Conditions
Agricultural buildings Class 7 Works consisting of the provision, on land not less than 10 metres from any public road the metalled part of which at the nearest point is more than 4 metres in width, of a roofed structure for the housing of pig, cattle, sheep or poultry, having a floor area not exceeding 400 square metres (whether or not by extension of an existing structure) and any ancillary provision for effluent storage.	1. No such structure shall be used for any purpose other than the purpose of agriculture 2. No such structure for the housing of pigs or poultry shall be situated within 100 metres of any dwelling-house save with the consent of the owner and occupier thereof. 3. No such structure within 100 metres of any public road shall exceed 7 metres in height above ground level. 4. No effluent from such structure shall be stored within 100 metres of any dwellinghouse save with the consent of the owner and occupier thereof.
Class 8 Works consisting of the provision, on land not less than 10 metres from any public road the metalled part of which at the nearest point is more than 4 metres in width, of roofless cubicles, open loose yards, self feed silo or silage areas, feeding aprons, assembly yards, milking parlours, sheep dipping units or structures for the making or storage of silage, having an aggregate floor area not exceeding 400 square metres, and any ancillary provision for effluent storage.	1. No such structure shall be used for any purpose other than the purpose of agriculture. 2. No such structure for the housing of pigs or poultry, or for the making, storage or feeding of silage shall be situated within 100 metres of any dwellinghouse save with the consent of the owner and occupier thereof. 3. No such structure within 100 metres of any public road shall exceed 7 metres in height above ground level. 4. No effluent from such structure shall be stored within 100 metres of any dwellinghouse save with the consent of the owner and occupier thereof.

PART III - (continued)

Column 1 Description of Development	Column 2 Conditions
Class 9 The construction, extension, alternation or replacement, on land not less than 10 metres from any public road the metalled part of which at the nearest point is more than 4 metres in width, of any store, barn, shed, glasshouse or other agricultural building not being of a type specified in Class 7 or 8 of this Part of this Schedule.	1. No such structure shall be used for any purpose other than the purpose of agriculture or forestry. 2. No such structure within 100 metres of any public road shall exceed 7 metres in height above ground level.

PART IV
CLASSES OF USE

CLASS 1 - Use as a shop for any purpose except as -

(a) a fried fish shop or a shop for the sale of hot food for consumption off the premises,

(b) a shop for the sale of pet animals or birds,

(c) a shop for the sale or display for sale of motor vehicles other than bicycles.

CLASS 2 - Use as an office for any purpose.

CLASS 3 - Use as light industrial building for any purpose.

CLASS 4 - Use as a general industrial building for any purpose.

Farm Modernisation Scheme

Aid for Investments etc.

A. Individuals

Notes: All grants are on the basis of approved cost. The prior approval of the Farm Development Service is required in all cases.

Development Farmers

Type of Investment / Region and Grant Level	Disadvantaged Areas i.e. Western region and Mountain Sheep Area in East	Normal Areas
	Grant	Grant
Land Improvement	55%	50%
Farm Buildings	40%	30%
Fixed Equipment	30%	30%
Mobile Equipment	10%	10%
Stock Purchases	10%	10%
Tourist or craft purpose	40%	Nil

In addition the development farmer can get guidance premiums where he concentrates on beef/sheepmeat production/ and loan guarantees in certain exceptional circumstances. Priority access to land released under the Farm Retirement Scheme is given to farmers who can show that with the extra land they can follow a development plan.

All farmers are entitled to grants for keeping farm accounts.

Non Development Farmers

There is no distinction in the grant levels for non-development farmers as between normal and disadvantaged areas. By farm category the grants available throughout the country area:

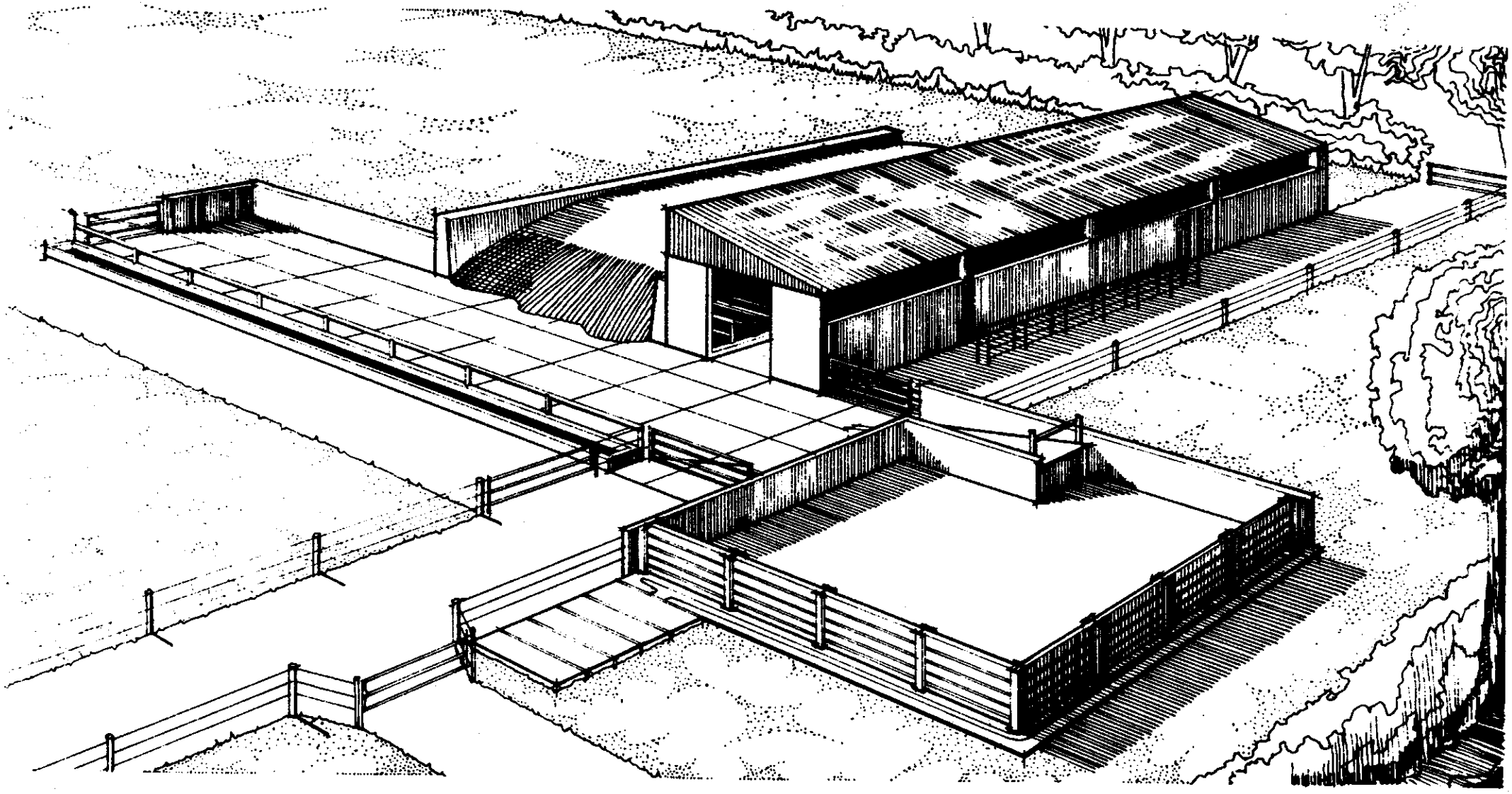
Farm Category / Type of Investment and aid level	Land Improvement	Fixed Assets i.e. Farm Buildings & Fixed Equipment
Commercial	40%	20%
Other (or Transitional) not eligible for retirement benefits i.e. under 55	50%	30%
Other eligible for retirement benefits (i.e. over 55)	40%	20%

Note:- Land Improvement and fixed assets constitute by far the bulk of the cost of onfarm investments.

B. Farm Groups or Joint Investment Aids

Nature of Investment / Area	Disadvantaged Areas	Normal Areas
	Rate of Grant	Rate of Grant
Land improvement		
(i) common outfall watercourse	50%	50%
(ii) enclosure of mountain grazing and/or related reclamation and surface treatment	60% subject to maximum of £50 per acre.	Nil
(iii) Other common land improvement works	50%	50%
Fixed Assets		
Facilities for handling livestock, shelters, improvement of external roadways	30%	30%
Farm Machinery for Fodder Production		
Machinery for harvesting etc. fodder crops	Up to 30% of listed price	Nil

Launching aid towards the organisation and management costs of farm groups is also available throughout the country.



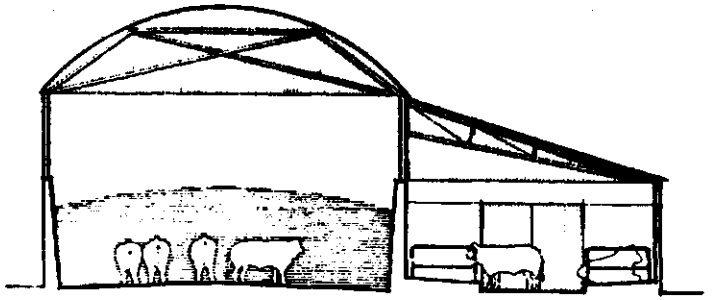
TYPICAL LOOSE HOUSE / CUBICLE UNIT

L. J. Hannagh. B. Arch. Architect

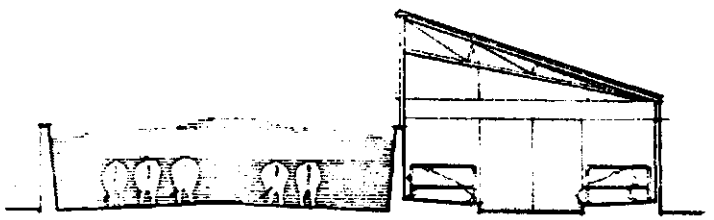
An Foras Talúntais
The Agricultural Institute

Farm Structures and Environment Department

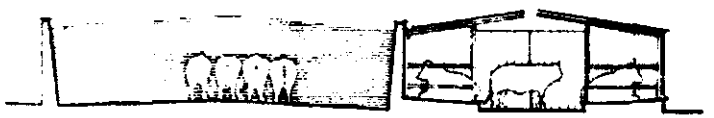
Figure. 1.



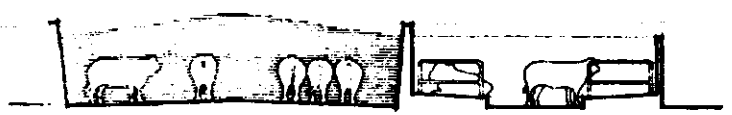
ROOFED SILO AND ROOFED CUBICLES



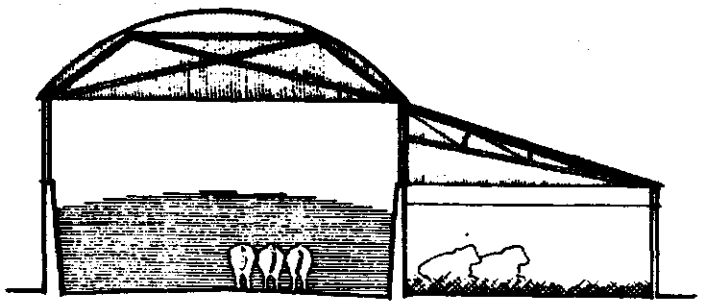
UNROOFED SILO AND ROOFED CUBICLES



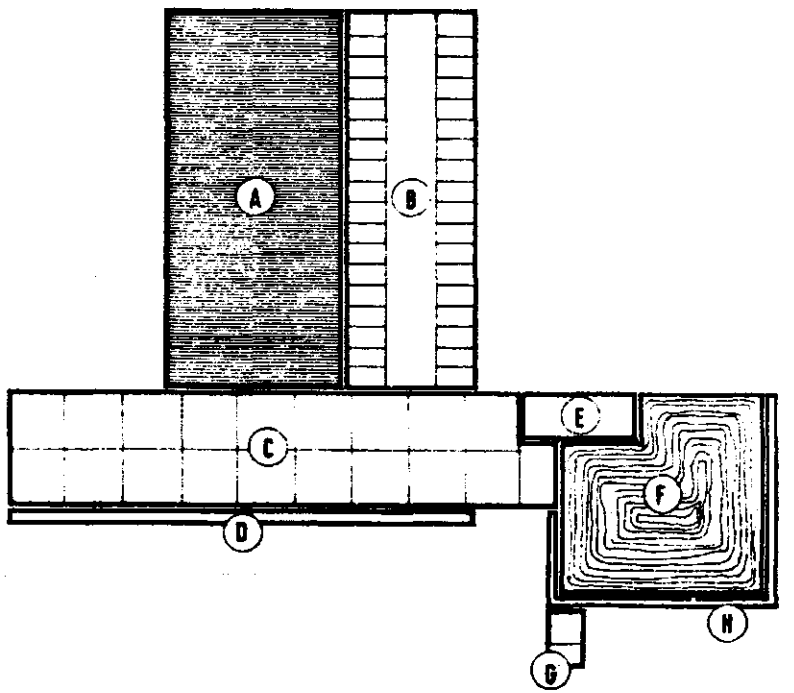
UNROOFED SILO AND KENNELS



UNROOFED SILO AND UNROOFED CUBICLES



ROOFED SILO AND ROOFED LOOSE STRAWED HOUSE



PLAN : SUITABLE FOR ALL HOUSE TYPES SHOWN

A. silo. 63'x36'[19200x9158]
200 tons [203 tonnes]

B. house. 63'x21'[19200x6400]
36 nos. cubicles or kennels at 3'6"[1075] centres OR 44 nos. animals at 30 sq.ft [2·8 m²] each, loose housed.

C exercise yard 22'[6700] wide

D. feeding trough. 2' [600] per 10 cwt [500 kg] animal

E ramp to dungstead. max. rise = 1 in 7

F. dungstead. 30 sq.ft [2·8m²] per animal

G. silage effluent and run-off collection tank and pumping chamber. 10 gals. [45 l.] per ton of silage.

H. dungstead run-off collection channel.

SELF-FEED SYSTEMS

35 TO 50 CATTLE

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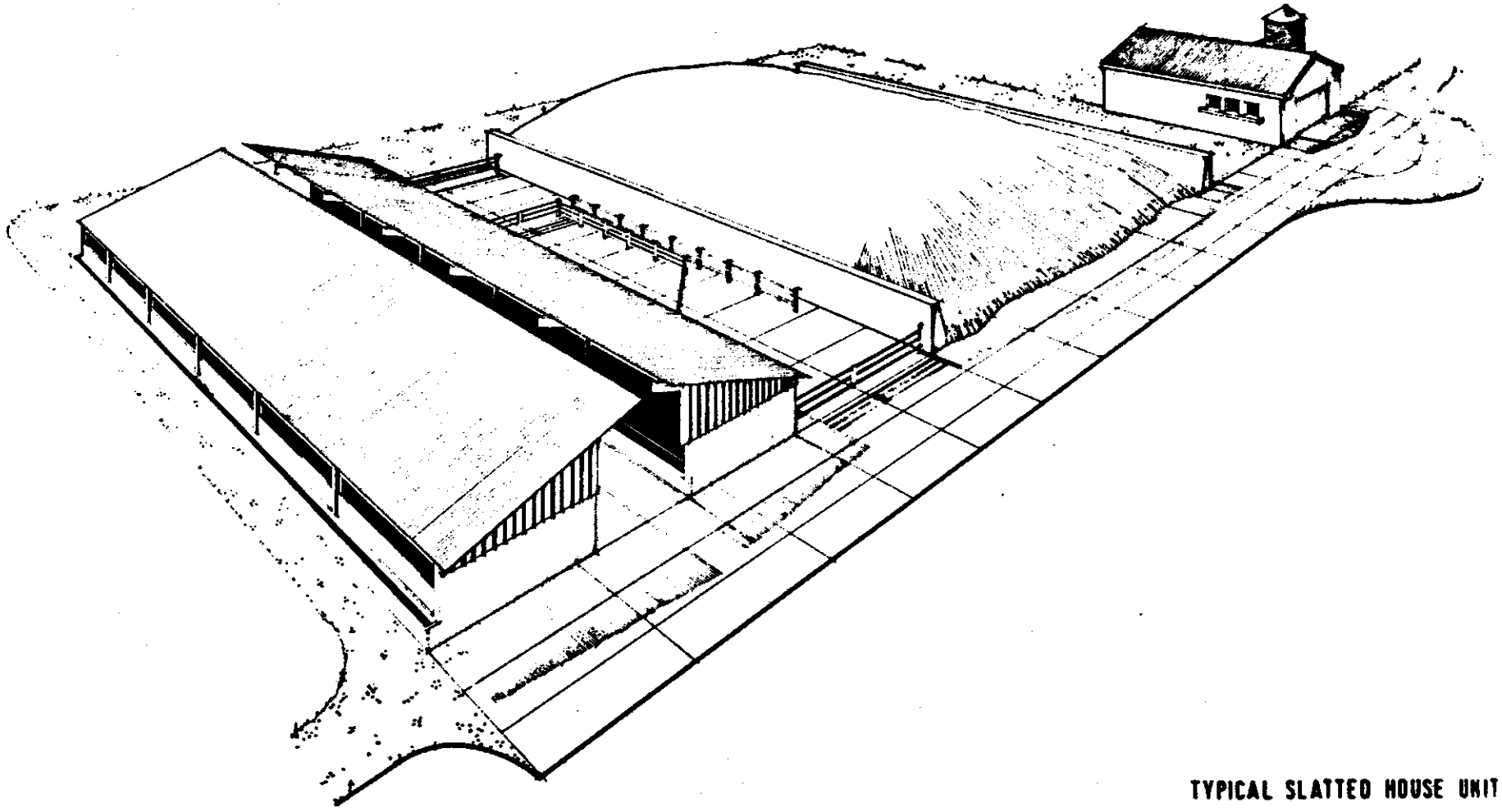
Figure . 2.



TYPICAL SLATTED HOUSE UNIT

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Figure 3.