

## APPENDIX.

## A.—THE INTRAPERITONEAL METHOD OF INSEMINATION.

(Tables 32 to 41.)

This appendix contains detailed data on the experimental and control inseminations and matings performed on pigeons and fowls in the *first* series of inseminations.

The data are given in the sequence followed in the text where reference was made to the corresponding tables, and as the tables are all *descriptive* and therefore *not suitable for statistical analysis*, the basic figures on which percentages and other relative information are based, are prominently stated, in order to show the scope and limitations of all data.

The environmental influences on the effects and results of the operations in fowls (see Part 6), as well as the total and control results, are set out in Tables 32 (Appendix) to 36 (Appendix). Owing to the limited space at the head of the columns, they have been numbered and a detailed consideration of each is given here:—

Table 32 (Appendix), contains data in respect of the influence of environmental factors on egg-production. Column (1) contains the short terms indicating the groups referred to in the text [Part (6)], column (2) gives the figures of the number of cases considered in each line and columns (3) and (4), show the volume of work on which the figures are based, including the total times of observation in "hen-days" and the total number of eggs recorded. The "hen-day" is a twenty-four hour observation on a single bird, i.e. three "hen-days" may stand for observation on one hen for three days, or on three hens for one day, or on one hen two days, plus a second hen one day. Columns 5 to 8 only refer to those cases (76) on which full data are available for a period of twenty-one days from the 10th day prior to insemination to the 10th day after. The number of such cases is given in column 5. The cases in which there was no change in production are listed in column 6 and where production was reduced in column 7, but the cases showing more eggs in the ten days after the operation than in the ten before are shown in column 8.

Table 33 (Appendix) supplies details in respect of the influence on fertility in the groups with different environmental circumstances. The columns here give details on the number of cases involved (column 2), the number of operations after which fertility was recorded, (column 3) and that number of such operations where it was possible to determine the full details of incubation (column 4), i.e. where the fertile eggs were definitely proved to have been fertilized by intraperitoneal insemination, the difference between columns 3 and 4 must be explained more fully, as it is due to the fact that not all fertile eggs hatched or developed far enough to show up the characteristics by which the paternity of the chicks could be determined. As it was possible that in several cases the fertility recorded might have been the result of previous or subsequent inseminations by various methods, all doubtful cases had to be discarded before proceeding with the analysis given in columns 5 to 10. The number of eggs set and the percentage fertile is shown in columns 5 and 6 respectively. In view of the fact that eggs laid within one day after insemination are not as likely to be fertile, as the eggs laid between those limits, the inclusion of such eggs may be regarded as a confusing factor in the data in column 6, and columns 7 and 8 are therefore inserted. Column 9 contains the average duration of fertility in days, i.e. the period between insemination and the laying of the last fertile eggs.

Similarly Table 34 (Appendix) shows the information with regard to hatchability in the same groups, the number of cases and the fertile eggs involved, being entered in columns 2 and 3 respectively (corresponding to columns 4 and 6 in Table 33). Chicks hatched, dead-in-shell and dead embryos are given in percentages in columns 4, 5 and 6 respectively and as in columns 7 and 8 of the previous table the results for the period between 24 hours and ten days after the operation are provided separately in columns 7 and 8. Column 9 here contains the average duration of hatchability in days.

The data on effects of the circumstances or qualities of pigeon hens on the results of intraperitoneal insemination are set out more fully in Table 35 (Appendix), showing the basis for the findings mentioned in Part (7) (a).

The information on fowl hens in connection with this aspect is given in detail in Tables 36, 37 and 38 (Appendix) respectively. The lines indicate the qualities exactly as they are shown in the text and these tables again merely supply the actual figures forming the basis for the report in Part (7) (b).

Similarly the type, shape and size of needle used for intraperitoneal insemination in fowls, and the materials which came in contact with the semen used as reported upon in Parts (8) (a) and (8) (b) are mentioned in Tables 39, 40 and 41 (Appendix) showing the figures used in the study of the effect of these factors on the results of intraperitoneal insemination. The columns again correspond with those of Tables 32, 33 and 34 (Appendix) and reference should again be made to the last two lines of these tables for control information.

ARTIFICIAL INSEMINATION OF BIRDS.

TABLE 32.  
*The effect of Season and Exposure on the Egg-production of Fowl Hens after Intraperitoneal Insemination.*

| Line. | Description of Environmental Factors ; Particulars of Groups.                      | Number of Cases of Insemination performed. | Number of observations made after Insemination in "Hen-days", i.e., as many times as one Hen was observed for one day. | Number of Eggs laid after Insemination including cracked Eggs and Premature Eggs. | Records of Egg-production for the period between the Tenth Day prior to Insemination to the Tenth Day after Insemination. |  |   |   |
|-------|--|--|--|---|---|--|---|---|
|       |  |  |  |   | Number of complete Records for the whole Period.  | Number of Cases with an equal Number of Eggs before and after. | Number of Cases with more Eggs before than after the Operation. | Number of Cases with more Eggs after than before the Operation. |
|       | Column (1)   | Column (2)                                 | Column (3)   | Column (4)  | Column (5)  | Column (6)   | Column (7)  | Column (8)  |
| a     | Season:—   |  |  |   |   |  |   |   |
| b     | July to December.....  | 78   | 1,442  | 782   | 50  | 12   | 27  | 12  |
|       | January to June.....   | 39   | 857  | 332   | 26  | 5  | 16  | 5   |
| c     | Exposure:—   |  |  |   |   |  |   |   |
| d     | Hens outdoors.....   | 88   | 1,779  | 894   | 55  | 11   | 34  | 10  |
|       | Hens indoors.....  | 29   | 520  | 220   | 21  | 6  | 8   | 7   |
| e     | Totals:—   | 117  | 2,299  | 1,114   | 76  | 17   | 42  | 17  |
| f     | Intraperitoneal insemination (first series).....                                   |  |  |   |   |  |   |   |
|       | Control inseminations <i>per vaginam</i> and by natural mating (first series)..... | 33   | 486  | 204   | 21  | 3  | 12  | 6   |

TABLE 33.  
*The Effect of Season and Exposure on the Fertility Following Intrapitoneal Insemination of Fowls.*

| Line. | Description of Environmental Factors; Particulars of Groups.        | Number of Cases of Insemination performed. | Number of Cases of Insemination followed by Fertile Eggs. | Number of Cases of Insemination that could be tested for results of incubation. | Number of Eggs set. | Percentage of Eggs set that were proved Fertile. | Number of Eggs laid 24 hours to Ten Days after Insemination that were set. | Percentage of Eggs laid 24 hours to Ten Days after that proved Fertile. | Average duration of Fertility. |
|-------|---|--|---|---|---------------------|--|--|---|--------------------------------|
|       | Column (1)  | Column (2)                                 | Column (3)  | Column (4)  | Column (5)          | Column (6)                                       | Column (7)   | Column (8)  | Column (9)                     |
| a     | Season:—  | 78   | 42  | 52  | 555                 | 27%  | 253  | 38%   | 10.4                           |
| b     | July to December.....   | 39   | 20  | 23  | 258                 | 28%  | 116  | 37%   | 10.9                           |
| c     | Exposure:—  | 88   | 47  | 55  | 634                 | 29%  | 268  | 40%   | 12.1                           |
| d     | Hens—   | 29   | 15  | 20  | 179                 | 22%  | 101  | 33%   | 6.7                            |
|       | Indoors.....  |  |   |   |                     |  |  |   |                                |
|       | Indoors.....  |  |   |   |                     |  |  |   |                                |
| e     | Totals:—  | 117  | 62  | 75  | 813                 | 27%  | 369  | 38%   | 10.8                           |
|       | Intrapitoneal insemination (first series)...                        |  |   |   |                     |  |  |   |                                |
| f     | Control inseminations <i>per vaginam</i> and by natural mating..... | 33   | 20  | 21  | 106                 | 82%  | 71   | 89%   | 13.9                           |

TABLE 34.  
*The Effect of Season and Exposure on the Hatchability Following Intraperitoneal Insemination of Fowl Hens.*

| Line. | Description of Environmental Factors; Particulars of Groups.                     | Number of Cases of Insemination that could be tested for Results of Incubation. | Number of Eggs proved Fertile. | Percentage of Fertile Eggs that Hatched. | Percentage of Fertile Eggs with Chicks dead in Shell. | Percentage of Fertile Eggs with dead Embryos. | Number of Eggs laid 24 hours to Ten Days after Insemination that proved Fertile. | Percentage of Eggs laid 24 hours to Ten Days after Insemination that Hatched. | Average duration of Hatchability in Days. |
|-------|--|---|--------------------------------|--|---|---|--|---|---|
|       | Column (1)   | Column (2)  | Column (3)                     | Column (4)                               | Column (5)  | Column (6)                                    | Column (7)   | Column (8)  | Column (9)                                |
| a     | Season:—   | 52  | 152                            | 53%                                      | 7%  | 40%   | 97   | 55%   | 8.2                                       |
| b     | July to December.....  | 23  | 70                             | 53%                                      | 26%   | 21%   | 43   | 60%   | 7.2                                       |
|       | January to June.....   |   |                                |  |   |   |  |   |   |
|       | Exposure:—   |   |                                |  |   |   |  |   |   |
| c     | Hens—  | 55  | 182                            | 50%                                      | 15%   | 35%   | 107  | 54%   | 9.0                                       |
| d     | Outdoors.....  | 20  | 40                             | 68%                                      | 7%  | 25%   | 33   | 64%   | 5.1                                       |
|       | Indoors.....   |   |                                |  |   |   |  |   |   |
| e     | Totals:—   | 75  | 222                            | 53%                                      | 13%   | 34%   | 140  | 56%   | 8.1                                       |
|       | Intraperitoneal insemination (first series)...                                   |   |                                |  |   |   |  |   |   |
| f     | Control inseminations <i>per vaginam</i> and by natural mating (first series)... | 21  | 87                             | 53%                                      | 20%   | 27%   | 63   | 52%   | 9.7                                       |

TABLE 35.  
*The Effect of Age, Egg-production and Previous Inseminations on the Results of Intrapritoneal Insemination in Pigeons.*

| Line | Description of Quality. | Particulars of Groups.         | No. of Inseminations. | NUMBER OF EGGS LAID 46 TO 97 HOURS AFTER INSEMINATION. |          |          |          |          |                |              | Remarks                    |
|------|-------------------------|--------------------------------|-----------------------|--|----------|----------|----------|----------|----------------|--------------|----------------------------|
|      |                         |                                |                       | Laid.  | Cracked. | Set.     | Fertile. | Hatched. | Dead in Shell. | Dead Embryos |                            |
|      |                         |                                | Col. (3)              | Col. (4)   | Col. (5) | Col. (6) | Col. (7) | Col. (8) | Col. (9)       | Col. (10)    | Col. (11)                  |
| a    | Age.....                | Column (2)<br>Young birds..... | 1                     | 0  | —        | —        | —        | —        | —              | —            | Col. (11)<br>Moult caused. |
| b    |                         | Yearlings.....                 | 12                    | 12   | 0        | 12       | 3        | 0        | 1              | 2            | —                          |
| c    |                         | Old birds.....                 | 49                    | 35   | 2        | 33       | 9        | 0        | 4              | 5            | —                          |
| d    |                         | Ten days or less.....          | 9                     | 6  | 0        | 6        | 0        | —        | —              | —            | —                          |
| e    |                         | 11 to 18 days.....             | 22                    | 16   | 1        | 15       | 5        | 0        | 3              | 2            | —                          |
| f    |                         | 19 to 30 days.....             | 31                    | 25   | 1        | 24       | 7        | 0        | 2              | 5            | —                          |
| g    |                         | Nil.....                       | 15                    | 12   | 0        | 12       | 2        | 0        | 0              | 2            | —                          |
| h    |                         | One.....                       | 14                    | 10   | 0        | 10       | 4        | 0        | 3              | 1            | —                          |
| i    |                         | Two.....                       | 11                    | 9  | 1        | 8        | 2        | 0        | 0              | 2            | —                          |
| j    |                         | Three to twelve.....           | 21                    | 15   | 1        | 14       | 3        | 0        | 2              | 1            | —                          |
| k    |                         | Thirteen.....                  | 1                     | 1  | 0        | 1        | 1        | 0        | 0              | 1            | —                          |

TABLE 36.  
The Effect of Some Qualities of the Subject on the Egg-production of Fowl Hens after Intraperitoneal Inseminations.

| Line. | Description of Quality ;<br>Particulars of Groups.  | Number of<br>Cases of<br>Insemina-<br>tion<br>performed. | Number of<br>observations<br>made after<br>Insemina-<br>tion in<br>" Hen-days ",<br>i.e., as many<br>times as one<br>Hen was<br>observed for<br>one day. | Number of<br>Eggs laid<br>after<br>Insemina-<br>tion,<br>including<br>cracked<br>Eggs and<br>Premature<br>Eggs. | Records of Egg-production for the period between<br>the Tenth Day prior to Insemination to the Tenth<br>Day after Insemination. |   |  |  |
|-------|---|--|--|---|---|---|--|--|
|       |   |  |  |   | Number of<br>Cases with<br>complete<br>Records for<br>the whole<br>Period.  | Number of<br>Cases with<br>an equal<br>Number of<br>Eggs before<br>and after. | Number of<br>Cases with<br>more Eggs<br>before than<br>after the<br>Operation. | Number of<br>Cases with<br>more Eggs<br>after than<br>before the<br>Operation. |
|       | Column (1)  | Column (2)   | Column (3)   | Column (4)  | Column (5)  | Column (6)  | Column (7)   | Column (8)   |
| a     | Breed:—<br>Heavy breeds.....  | 71   | 1,460  | 702   | 46  | 10  | 28   | 8  |
| b     | Light breeds.....   | 46   | 839  | 412   | 30  | 7   | 14   | 9  |
| c     | Age:—<br>Pullets.....   | 97   | 1,895  | 932   | 61  | 12  | 35   | 14   |
| d     | One year olds.....  | 16   | 345  | 182   | 12  | 4   | 5  | 3  |
| e     | Old birds.....  | 4  | 59   | 0   | 3   | 1   | 2  | 0  |
| f     | Production (during the ten days prior to<br>insemination in the only 108 cases in<br>which complete records were available)   | 53   | 980  | 364   | 36  | 11  | 12   | 13   |
| g     | 60 per cent. and under.....<br>Over 60 per cent.....  | 55   | 1,144  | 660   | 40  | 6   | 30   | 4  |
| h     | Previous Inseminations (time interval<br>since the last insemination prior to the<br>reported intraperitoneal inseminations<br>and the method used for these previous<br>inseminations):— |  |  |   |   |   |  |  |
| i     | Intraperitoneal within 48 hours.....  | 26   | 532  | 314   | 19  | 6   | 9  | 4  |
| j     | Other methods within 48 hours.....  | 16   | 393  | 171   | 8   | 1   | 7  | 0  |
| k     | Intraperitoneal ten to two days before  | 9  | 143  | 79  | 5   | 0   | 4  | 1  |
| l     | Other methods ten to two days before  | 2  | 39   | 20  | 2   | 0   | 1  | 1  |
| m     | All methods more than ten days before   | 43   | 817  | 382   | 35  | 8   | 18   | 9  |
|       | No previous inseminations.....  | 21   | 375  | 146   | 77  | 2   | 3  | 2  |

TABLE 37.

*The Effect of Some Qualities of the Subject Inseminated on the Fertility Following Intra-peritoneal Insemination of Fowls.*

| Line. | Description of Quality; Particulars of Groups.  | Number of Cases of Insemination performed. | Number of Cases of Insemination followed by Fertile Eggs. | Number of Cases of Insemination that could be tested for results of incubation. | Number of Eggs set. | Percentage of Eggs set that were proved Fertile. | Number of Eggs laid 24 hours to Ten Days after Insemination that were set. | Percentage of Eggs laid 24 hours to Ten Days after that proved Fertile. | Average duration of Fertility. |
|-------|---|--|---|---|---------------------|--|--|---|--------------------------------|
|       | Column (1)  | Column (2)                                 | Column (3)  | Column (4)  | Column (5)          | Column (6)                                       | Column (7)   | Column (8)  | Column (9)                     |
| a     | Breed:—   | 71   | 38  | 41  | 496                 | 33%  | 205  | 47%   | 12.7                           |
| b     | Heavy breeds.....   | 46   | 24  | 34  | 317                 | 18%  | 164  | 29%   | 7.4                            |
| c     | Age:—   | 97   | 50  | 65  | 701                 | 27%  | 316  | 38%   | 10.8                           |
| d     | Pullets.....  | 16   | 12  | 10  | 112                 | 27%  | 53   | 45%   | 7.4                            |
| e     | One year olds.....  | 4  | 0   | 0   | 0                   | 0  | 0  | 0   | 0                              |
|       | Old birds.....  |  |   |   |                     |  |  |   |                                |
| f     | Production (during the ten days prior to insemination) (108 cases only, as no record was available in the other nine cases)—  | 53   | 18  | 30  | 281                 | 16%  | 144  | 22%   | 8.6                            |
| g     | 60 per cent. and under..  | 55   | 38  | 38  | 460                 | 37%  | 187  | 54%   | 11.9                           |
|       | Over 60 per cent.....   |  |   |   |                     |  |  |   |                                |
| h     | Previous Insemination (time interval since last insemination before those of which the results are given here were performed and the method used for these previous inseminations)— | 26   | 16  | 14  | 169                 | 34%  | 76   | 41%   | 13.1                           |
| i     | Intra-peritoneal within 48 hours.....   | 16   | 12  | 6   | 66                  | 56%  | 25   | 76%   | 16.0                           |
| j     | Other methods within 48 hours.....  | 9  | 6   | 8   | 72                  | 40%  | 41   | 51%   | 8.8                            |
| k     | Intra-peritoneal ten to two days before.....  | 2  | 2   | 2   | 20                  | 15%  | 11   | 27%   | 3.0                            |
| l     | Other methods ten to two days before.....   | 43   | 21  | 32  | 358                 | 22%  | 155  | 35%   | 9.7                            |
| m     | More than ten days before No previous insemination recorded.....  | 21   | 5   | 13  | 123                 | 15%  | 61   | 20%   | 8.2                            |

G. C. VAN DRIMMELEN.

TABLE 38.  
The Effect of Some Qualities of the Fowl Hens Inseminated on the Hatchability Following Intra-peritoneal Insemination.

| Line. | Description of Quality; Particulars of Groups.  | Number of Cases of Insemination that could be tested for Results of Incubation. | Number of Eggs proved Fertile. | Percentage of Fertile Eggs that Hatched. | Percentage of Fertile Eggs with Chicks dead in Shell. | Percentage of Fertile Eggs with dead Embryos. | Number of Eggs laid 24 hours to Ten Days after Insemination that proved Fertile. | Percentage of Eggs laid 24 hours to Ten Days after Insemination that Hatched. | Average duration of Hatchability in Days. |
|-------|---|---|--------------------------------|--|---|---|--|---|---|
|       | Column (1)  | Column (2)  | Column (3)                     | Column (4)                               | Column (5)  | Column (6)                                    | Column (7)   | Column (8)  | Column (9)                                |
| a     | Breed:—   |   |                                |  |   |   |  |   |   |
| b     | Heavy breeds.....   | 41  | 164                            | 48%                                      | 14%   | 38%   | 96   | 47%   | 9.4                                       |
|       | Light breeds.....   | 34  | 58                             | 69%                                      | 9%  | 22%   | 48   | 71%   | 5.6                                       |
| c     | Age:—   |   |                                |  |   |   |  |   |   |
| d     | Pullets.....  | 65  | 190                            | 55%                                      | 15%   | 30%   | 120  | 59%   | 8.1                                       |
| e     | One year olds.....  | 10  | 30                             | 40%                                      | 3%  | 57%   | 24   | 33%   | 6.7                                       |
|       | Old birds.....  | 4   | 0                              | 0%                                       | 0%  | 0%  | 0  | 0%  | 0   |
| f     | Production (egg-production during the ten days prior to insemination in 108 cases in which the records were complete)—                    |   |                                |  |   |   |  |   |   |
| g     | 60 per cent. and under...<br>Over 60 per cent.....  | 30<br>38  | 44<br>160                      | 55%<br>52%                               | 27%<br>11%  | 18%<br>37%                                    | 35<br>101  | 60%<br>56%  | 4.6<br>9.3                                |
| h     | Previous Insemination (intervals of time since the last previous insemination and also the method used for these previous inseminations)— |   |                                |  |   |   |  |   |   |
| i     | Intra-peritoneal within 48 hours before.....  | 14  | 57                             | 49%                                      | 2%  | 49%   | 31   | 52%   | 12.6                                      |
| j     | Other methods within 48 hours before.....   | 6   | 37                             | 49%                                      | 15%   | 36%   | 19   | 42%   | 12.8                                      |
| k     | Intra-peritoneal, ten to two days before.....   | 8   | 29                             | 79%                                      | 7%  | 14%   | 22   | 70%   | 7.0                                       |
| l     | Other methods, ten to two days before.....  | 2   | 3                              | 33%                                      | 0%  | 67%   | 3  | 33%   | 1.5                                       |
| m     | All methods more than ten days before.....  | 32  | 78                             | 53%                                      | 18%   | 29%   | 56   | 58%   | 6.4                                       |
|       | Not previously inseminated.....   | 13  | 18                             | 39%                                      | 39%   | 22%   | 12   | 50%   | 4.6                                       |



TABLE 39.

*The Influence of the Shape, Size and Materials of Construction of the Instruments used on the Egg-production after the Operation for Intrapertoneal Insemination in Fowl Hens.*

| Line. | Description of Shape, Size and Materials of Instruments; Particulars of Groups.     | Number of Cases of Insemination performed. | Number of observations made after Insemination in "Hen-days", i.e., as many times as one Hen was seen for one day. | Number of Eggs laid after Insemination, including cracked Eggs and Premature Eggs. | Records of Egg-production for the period between the Tenth Day prior to Insemination and the Tenth Day after Insemination. |  |   |   |
|-------|---|--|--|--|--|--|---|---|
|       |   |  |  |  | Number of Cases with complete Records for the whole Period.  | Number of Cases with an equal Number of Eggs before and after. | Number of Cases with more Eggs before than after the Operation. | Number of Cases with more Eggs after than before the Operation. |
|       | Column (1)  | Column (2)                                 | Column (3)   | Column (4)   | Column (5)   | Column (6)   | Column (7)  | Column (8)  |
| a     | Type : Shape :—   |  |  |  |  |  |   |   |
| b     | Sharp needles.....  | 73   | 1,459  | 673  | 47   | 4  | 23  | 7   |
|       | Blunt needles.....  | 44   | 840  | 441  | 29   | 2  | 19  | 10  |
| c     | Type : Size :—  |  |  |  |  |  |   |   |
| d     | Coarse needles.....   | 76   | 1,612  | 725  | 49   | 5  | 24  | 8   |
|       | Fine needles.....   | 41   | 687  | 389  | 27   | 1  | 18  | 9   |
| e     | Materials :—  |  |  |  |  |  |   |   |
| f     | Metal nozzle, piston and needles.....   | 34   | 586  | 317  | 19   | 6  | 8   | 5   |
| g     | Metal piston and needles.....   | 25   | 543  | 175  | 16   | 4  | 8   | 3   |
| h     | Metal needles but all-glass syringe.....  | 28   | 553  | 302  | 19   | 3  | 12  | 4   |
| i     | Wax-coated metal needles and all-glass syringe.....                                 | 23   | 423  | 250  | 18   | 2  | 12  | 4   |
|       | Special all-glass syringe with long nozzle used through canula without needles..... | 7  | 194  | 70   | 4  | 1  | 2   | 1   |

ARTIFICIAL INSEMINATION OF BIRDS.

TABLE 40.  
*The Influence of Size, Shape and Materials of Construction of the Instruments used, on the Fertility Following Intrapertoneal Insemination of Fowls.*

| Line. | Description of Type and Materials of Instruments; Particulars of Groups. | Number of Cases of Insemination performed. | Number of Cases of Insemination followed by Fertile Eggs. | Number of Cases of Insemination that could be tested for results of incubation. | Number of Eggs set. | Percentage of Eggs set that were proved Fertile. | Number of Eggs laid 24 hours to Ten Days after Insemination that were set. | Percentage of Eggs laid 24 hours to Ten Days after Insemination proved Fertile. | Average duration of Fertility. |
|-------|--|--|---|---|---------------------|--|--|---|--------------------------------|
|       | Column (1)   | Column (2)                                 | Column (3)  | Column (4)  | Column (5)          | Column (6)                                       | Column (7)   | Column (8)  | Column (9)                     |
| a     | Type: Shape:—  |  |   |   |                     |  |  |   |                                |
| b     | Sharp needles.....   | 73   | 38  | 43  | 495                 | 30%  | 213  | 43%   | 8.4                            |
|       | Blunt needles.....   | 44   | 24  | 32  | 318                 | 22%  | 156  | 31%   | 7.4                            |
| c     | Type: Size:—   |  |   |   |                     |  |  |   |                                |
| d     | Coarse needles.....  | 76   | 42  | 45  | 441                 | 35%  | 216  | 44%   | 8.5                            |
|       | Fine needles.....  | 41   | 20  | 30  | 372                 | 17%  | 153  | 29%   | 10.0                           |
| e     | Materials:—  |  |   |   |                     |  |  |   |                                |
| f     | Metal nozzle, piston and needles.....                                    | 34   | 16  | 24  | 231                 | 17%  | 114  | 26%   | 9.3                            |
| g     | Metal piston and needles   | 25   | 11  | 15  | 135                 | 22%  | 63   | 30%   | 9.3                            |
|       | Metal needles but all-glass syringe.....                                 | 28   | 16  | 18  | 255                 | 32%  | 101  | 51%   | 12.6                           |
| h     | Wax-coated metal needles and all-glass syringe..                         | 23   | 14  | 14  | 155                 | 32%  | 77   | 44%   | 11.1                           |
| i     | Special all-glass syringe with long nozzle used (canula) without needle  | 7  | 5   | 4   | 38                  | 26%  | 14   | 43%   | 10.1                           |

TABLE 41.  
*The Influence of Type and Materials of Construction of the Instruments used,  
 on the Hatchability Following Intraperitoneal Insemination of Fowls.*

| Line. | Description of Type and Materials of Instruments; Particulars of Groups.           | Number of Cases of Insemination that could be tested for Results of incubation. | Number of Eggs proved Fertile. | Percentage of Fertile Eggs that Hatched. | Percentage of Fertile Eggs with Chicks dead in Shell. | Percentage of Fertile Eggs with dead Embryos. | Number of Eggs laid 24 hours to Ten Days after Insemination proved Fertile. | Percentage of Eggs laid 24 hours to Ten Days after Insemination that Hatched. | Average duration of Hatchability in days after Insemination. |
|-------|--|---|--------------------------------|--|---|---|---|---|--|
|       | Column (1)   | Column (2)  | Column (3)                     | Column (4)                               | Column (5)  | Column (6)                                    | Column (7)  | Column (8)  | Column (9)   |
| a     | Type: Shape:—  | 43  | 152                            | 56%                                      | 18%   | 26%   | 96  | 64%   | 8.2  |
| b     | Sharp needles.....   | 32  | 70                             | 49%                                      | 2%  | 49%   | 48  | 42%   | 7.4  |
| c     | Blunt needles.....   |   |                                |  |   |   |   |   |  |
| d     | Type: Size:—   | 45  | 158                            | 56%                                      | 17%   | 27%   | 95  | 61%   | 8.2  |
| e     | Coarse needles.....  | 30  | 64                             | 48%                                      | 4%  | 48%   | 45  | 47%   | 7.1  |
| f     | Fine needles.....  |   |                                |  |   |   |   |   |  |
| g     | Materials:—  |   |                                |  |   |   |   |   |  |
| h     | Metal nozzle, piston and needles.....  | 24  | 40                             | 57%                                      | 3%  | 40%   | 30  | 53%   | 5.6  |
| i     | Metal piston and needles   | 15  | 30                             | 44%                                      | 33%   | 23%   | 19  | 49%   | 5.3  |
|       | Metal needles but all-glass syringe.....   | 18  | 83                             | 60%                                      | 16%   | 24%   | 51  | 69%   | 10.1   |
|       | Wax-coated metal needles and all-glass syringe..                                   | 14  | 59                             | 44%                                      | 9%  | 47%   | 34  | 50%   | 9.3  |
|       | Special all-glass syringe with long nozzle used through canula without needle..... | 4   | 10                             | 60%                                      | —   | 40%   | 6   | 33%   | 9.0  |

## APPENDIX.

## B.—THE FOWL COCKS AND THE SEMEN SAMPLES USED.

(Tables 45 to 50 and 58 to 59.)

In this Appendix attention is paid to detail in connection with the fowl cocks and the samples of fowl semen used in the present work, and it refers particularly to Part (1) (b), Part (9), and Part (10).

*List of Males.*

The following is a short description of each of the fowl cocks from which samples were collected by the modified method given in Part (1) (b), Experiment (2). The collections made by the methods of Parker (1939) and Burrows and Quinn (1935, 1939) were not used to obtain samples for insemination.

(1) *Number 6.*—White Leghorn cock obtained from a commercial poultry farm at the age of approximately ten months. Placed in a laying-battery cage for the full period during which the four series of inseminations were carried out. The first six months he was kept outdoors, then dubbed and indoors for two months and from then on remained outdoors.

(2) *Number 14.*—South African Black Australorp cock of high quality, loaned from a large poultry farm for a few weeks only. This cock had shown poor fertility at the time.

(3) *Number 18.*—Barred Plymouth Rock cockerel obtained from a small stud-poultry farm, bred from parents imported from Canada in their first season. Died after three months.

(4) *Number 22.*—Buff Plymouth Rock cock used straight from the fowl run of a small poultry plant.

(5) *Number 23.*—White Leghorn cockerel very young, kept indoors in a laying-battery cage and slaughtered after four months.

(6) *Number 33.*—Barred Plymouth Rock cockerel out of imported stock. Stolen after two months in outdoor battery.

(7) *Number 34.*—Barred Plymouth Rock cockerel out of imported stock, loaned from a stud farm for one month and kept in the outdoor battery.

(8) *Number 35.*—White Leghorn cockerel from the Onderstepoort poultry plant kept indoors in a laying-battery cage for two months, then outdoors until 20 months old when he died from diarrhoea.

(9) *Number 36.*—Indian Game cock temporarily kept for transit from one plant to another.

(10) *Number 37.*—White Leghorn Cockerel from the Onderstepoort poultry plant, kept in outdoor battery and slaughtered after six months for observations on the semen in the male organs.

(11) *Number 38.*—Rhode Island Red cock kept in outdoor battery for six months.

(12) *Number 44.*—Barred Plymouth Rock cock loaned for three months from a stud-poultry farm.

(13) *Number 47.*—Wyandotte cock from an urban poultry run: kept in a laying-battery cage for 16 months.

(14) *Number 48.*—S.A. Black Australorp stud cock loaned from a poultry farm for a few days.

(15) *Number 53.*—Barred Plymouth Rock cock from imported stock kept for 16 months in the laying-battery cage out-doors.

(16) *Number 55.*—Rhode Island Red cock specially selected for semen production from a large poultry plant and kept in outdoor cages for one year.

(17) *Number 61.*—Indian Game cock from a large poultry farm, kept in outdoor battery for six months.

(18) *Number 62.*—Indian Game  $\times$  Buff Rock crossbred produced from intraperitoneal insemination Number 47 in the first series.

(19) to (23) *Numbers 63 to 67.*—White Leghorn males loaned from the Onderstepoort poultry plant during the fourth series of inseminations in the first month of the breeding season (July).

*Semen Examination.*

A record of the examinations and tests to which some semen samples were subjected is set out in detail in Table 45 (Appendix) wherein the number of samples submitted to each testing method is shown in a separate column followed by the calculated average result in the next column. As mentioned in the text in Part (9) (b), the collections have been grouped in separate lines in respect of age of the bird and season during which collected, because they were not made at the same time but were distributed over a number of years.

*Fertility Tests.*

Fertility tests are mentioned in the last columns of Table 45 (Appendix). For a detailed analysis of the results in the first series of inseminations (117 intraperitoneal and 73 controls); Tables 46 to 48 (Appendix) were compiled. An individual comparison (lines a to l) is given, as the number of birds involved is small and the controls available are given below (insemination *per vaginam* lines a to f). For purposes of this analysis every sample of semen inseminated is considered as a case of insemination, e.g. where semen of three males has been mixed and given in one operation this is reported as three cases.

In Table 46 (Appendix) columns 1 to 3 contain the particulars of the cocks from which semen was collected. Column 4 gives the number of times hens were inseminated with semen from each male. Column 5 shows in which number of cases of insemination eggs, which could be incubated were obtained. Column 6 shows the percentage of such cases in which fertility was proved after insemination. The fertility referred to here was, however, not in all cases proved to be due to the semen of the particular male, as in some cases other semen was inseminated simultaneously or previously or later. Only where chicks developed far enough, to determine the paternity of the embryo, was it possible to decide whether fertility had resulted from the particular semen or not. The cases are analysed in columns 1 to 10. Column 7 contains the unidentified group, i.e., in which the paternity of the embryos could not be determined. Column 8 shows the number of cases in which the sperms of the relative cock were unsuccessful in fertilizing any eggs when in competition with the sperms of other cocks present in the hen at the same time. This means that they were superseded but it must not be taken as proof of their inability to fertilize eggs, which they might have done, if no other sperms had been present at the same time. Column 9 gives the number of times that the sperms of the relative cock definitely succeeded in competition with the sperms of other males present in the hen at the time, i.e., all the fertile eggs developing far enough to determine the presence of characteristics inherited from the father of the chick showed characteristics of the relative cock only. Column 10 contains the successful insemination with pure semen of the relative cock. The fertility obtained from each male is analysed in Table 47 (Appendix), which is comparable with Tables 33, 37 and 40 (Appendix); in this Table 47, columns 1 and 2 correspond to the first two in Table 46; column 3 to column 4 in Table 46 and column 4 to the sum of columns 9 and 10 in Table 46. Column 5 contains the total number of eggs set after these inseminations and column 6, the gross percentage fertile. Column 7 shows only those eggs laid in the first ten days after insemination and thus a better comparison can be drawn from the percentage of these eggs which were proved to be fertile, as shown in column 8. Column 9 gives the average number of days between insemination and the laying of the last egg which proved to be fertile.

In Table 48 (Appendix) an analysis of the hatching results obtained from cocks used in the first series is shown on similar lines. Columns 1 to 4 are the same as in Table 47 (Appendix), but columns 5 to 11 are comparable to columns in Tables 34, 38 and 41 (Appendix).

Column 5 gives the number of eggs proved fertilized by sperm from the relative male.

Columns 6, 7 and 8 contain the gross incubation results in percentages.

Column 9 shows the number fertile in ten days after insemination and the hatchability percentages of these are given for better comparison in column 10.

Column 11 shows the length of the period between insemination and the laying of the last egg which hatched.

*Dosage of Semen.*

The dose of semen used for insemination varied only slightly in the *first* series of inseminations but in the *third* series some very large doses were given. Out of the total of 179 intraperitoneal inseminations 111 could be tested as the rest were either done with semen stored longer than 30 minutes (31 cases) or with diluted semen (24 cases) or the sperm in the semen were superseded by sperm introduced with other methods of insemination. Also in a number of cases simultaneous inseminations by the intraperitoneal method were taken together as one case, taking the total amount of semen injected as the size of the dose given. The results are set out in Tables 49 and 50 (Appendix), in the same way as previous data on fertility and hatchability [Tables 33, 37, 40, 47 and 34, 38, 41, 48 (Appendix)].

## ARTIFICIAL INSEMINATION OF BIRDS.

### *Biological Relations of Spermatozoa in the Hen.*

Further detail, supplementary to that given in the text of Part (10) is set out in Tables 58 and 59 (Appendix). Table 58 (Appendix) refers to 11 cases of simultaneous inseminations by different methods in the first series of inseminations completed and the following aspects have been considered:—

- (a) The methods or routes of insemination.
- (b) The donors of the semen used.
- (c) The amounts of semen used.
- (d) The instruments employed in the case of artificial inseminations.

Heavy type is used to indicate the successful inseminations.

Table 59 (Appendix) is a more detailed summary forming the basis for the data reported in the text (Table 59) and showing the scope (admittedly limited) of this part of the work, i.e. the total number of tests recorded (simultaneous operations are here taken as one case of insemination, i.e., 230 inseminations are given as 186 cases of insemination) and the number of cases of proved paternity in the *first* and *third* series of experimental and control inseminations.

The Record of Semen Collections made by the Author's Method for Fowl Cocks;

| Line. | Number given to each Cock. | Age of the Cock at collection. | Number of collections attempted during July to December. | Number of collections attempted during January to June. | Percentage of collections successful. | Percentage of Semen Samples Soiled. | Average Volume of Semen obtained per collection in ml. | Estimated viscosity of the Semen. | Colour of the Semen. | MOTILITY OF THE SPERMA        |                   |                              |                   |                            |                   |
|-------|----------------------------|--------------------------------|--|---|---------------------------------------|-------------------------------------|--|-----------------------------------|----------------------|-------------------------------|-------------------|------------------------------|-------------------|----------------------------|-------------------|
|       |                            |                                |  |   |                                       |                                     |  |                                   |                      | Nil-1 Hours <i>in vitro</i> . |                   | 6-24 Hours <i>in vitro</i> . |                   | 48 Hours <i>in vitro</i> . |                   |
|       |                            |                                |  |   |                                       |                                     |  |                                   |                      | Number of Tests.              | Average Motility. | Number of Tests.             | Average Motility. | Number of Tests.           | Average Motility. |
| a     | 6                          | Yearling.....                  | 5  | Column (4)  | Column (5)                            | Column (6)                          | Column (7)   | Column (8)                        | Column (9)           | Col. (10)                     | Col. (11)         | Col. (12)                    | Col. (13)         | Col. (14)                  | Col. (15)         |
| b     | 6                          | Yearling.....                  | 5  | 17  | 100%                                  | 20%                                 | 0.42 ml.   | 0.25                              | Ivory white.....     | 15                            | 1.0               | —                            | —                 | —                          | —                 |
| c     | 6                          | Two year old.....              | 28   | —   | 100%                                  | 6%                                  | 0.391 ml.  | 0.25                              | Ivory white.....     | 6                             | 1.0               | —                            | —                 | 3                          | 0.1               |
| d     | 6                          | Two year old.....              | 12   | 14  | 93%                                   | 26%                                 | 0.379 ml.  | 0.25                              | Ivory white.....     | 3                             | 1.0               | —                            | —                 | —                          | —                 |
| e     | 6                          | Three year old.....            | 12   | —   | 93%                                   | 28%                                 | 0.338 ml.  | 0.25                              | Ivory white.....     | 2                             | 1.0               | 1                            | 0.9               | —                          | —                 |
| f     | 14                         | Old bird.....                  | 2  | —   | 100%                                  | —                                   | 0.75 ml.   | 0.4                               | Ivory white.....     | —                             | —                 | —                            | —                 | 1                          | 0.4               |
| g     | 18                         | Yearling.....                  | 3  | 1   | 100%                                  | —                                   | 0.7 ml.  | 0.4                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| h     | 22                         | Young bird.....                | —  | —   | 100%                                  | —                                   | 0.2 ml.  | 0.95                              | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| i     | 23                         | Young bird.....                | —  | 9   | 78%                                   | 28%                                 | 0.25 ml.   | 0.95                              | Ivory white.....     | 4                             | 0.8               | —                            | —                 | —                          | —                 |
| j     | 33                         | Young bird.....                | —  | 4   | 100%                                  | 50%                                 | 0.45 ml.   | 0.4                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| k     | 34                         | Young bird.....                | —  | 6   | 100%                                  | 33%                                 | 0.65 ml.   | 0.4                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| l     | 35                         | Yearling.....                  | 4  | —   | 75%                                   | 50%                                 | 0.567 ml.  | 0.65                              | Ivory white.....     | 1                             | 1.0               | —                            | —                 | —                          | —                 |
| m     | 35                         | Yearling.....                  | —  | 7   | 28%                                   | —                                   | 0.371 ml.  | 0.75                              | Ivory white.....     | 1                             | 1.0               | —                            | —                 | —                          | —                 |
| n     | 37                         | Yearling.....                  | 6  | —   | 67%                                   | 25%                                 | 0.5 ml.  | 0.55                              | Ivory white.....     | 1                             | 0.9               | 1                            | 0.0               | —                          | —                 |
| o     | 38                         | Young bird.....                | —  | 7   | 100%                                  | 72%                                 | 0.386 ml.  | 0.7                               | Ivory white.....     | 1                             | 0.8               | —                            | —                 | —                          | —                 |
| p     | 38                         | Yearling.....                  | 18   | —   | 89%                                   | 54%                                 | 0.309 ml.  | 0.65                              | Ivory white.....     | 2                             | 0.8               | 1                            | 0.8               | —                          | —                 |
| q     | 44                         | Yearling.....                  | 15   | —   | 100%                                  | 13%                                 | 0.609 ml.  | 0.45                              | Ivory white.....     | 2                             | 0.9               | 1                            | 0.9               | —                          | —                 |
| r     | 47                         | Yearling.....                  | 20   | —   | 95%                                   | 25%                                 | 0.505 ml.  | 0.3                               | Once yellowish.....  | 1                             | 1.0               | —                            | —                 | —                          | —                 |
| s     | 47                         | Yearling.....                  | —  | 14  | 93%                                   | 7%                                  | 0.554 ml.  | 0.3                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| t     | 47                         | Two year old.....              | 16   | —   | 100%                                  | 0%                                  | 0.657 ml.  | 0.3                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| u     | 48                         | Old bird.....                  | 2  | —   | 100%                                  | 0%                                  | 0.7 ml.  | 0.4                               | Ivory white.....     | 2                             | 1.0               | 1                            | 0.9               | 1                          | 0.5               |
| v     | 53                         | Yearling.....                  | 8  | —   | 78%                                   | 37%                                 | 0.558 ml.  | 0.55                              | Some yellowish.....  | 1                             | 1.0               | —                            | —                 | —                          | —                 |
| w     | 53                         | Yearling.....                  | —  | 14  | 72%                                   | 42%                                 | 0.433 ml.  | 0.65                              | Some yellowish.....  | —                             | —                 | —                            | —                 | —                          | —                 |
| x     | 53                         | Two year old.....              | 12   | —   | 100%                                  | 33%                                 | 0.650 ml.  | 0.75                              | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| y     | 55                         | Yearling.....                  | 7  | —   | 100%                                  | 42%                                 | 0.714 ml.  | 0.9                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| z     | 55                         | Yearling.....                  | —  | 13  | 100%                                  | 70%                                 | 0.625 ml.  | 0.85                              | Some yellowish.....  | 1                             | 0.9               | 1                            | 0.5               | —                          | —                 |
| aa    | 55                         | Two year old.....              | 10   | —   | 100%                                  | 100%                                | 0.425 ml.  | 0.9                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| bb    | 61                         | Yearling.....                  | —  | 2   | 50%                                   | —                                   | 0.5 ml.  | 0.3                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| cc    | 61                         | Two year old.....              | 11   | —   | 91%                                   | 20%                                 | 0.43 ml.   | 0.3                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| dd    | 62                         | Young bird.....                | —  | 1   | 100%                                  | —                                   | 0.23 ml.   | 0.35                              | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| ee    | 62                         | Yearling.....                  | 9  | —   | 100%                                  | 10%                                 | 0.239 ml.  | 0.4                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| ff    | 63                         | Old bird.....                  | 3  | —   | 33%                                   | —                                   | 0.03 ml.   | 0.3                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| gg    | 64                         | Old bird.....                  | 2  | —   | 100%                                  | —                                   | 0.325 ml.  | 0.55                              | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| hh    | 65                         | Old bird.....                  | 2  | —   | 50%                                   | —                                   | 0.1 ml.  | 0.4                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |
| ii    | 67                         | Old bird.....                  | 3  | —   | 33%                                   | —                                   | 0.1 ml.  | 0.4                               | Ivory white.....     | —                             | —                 | —                            | —                 | —                          | —                 |

n/u. = nothing unusual.

abn. = abnormal spermatozoa in large proportion: (1), (2) and (3); many s

TABLE 45.  
Fowl Cocks; and the Description of the Samples of Semen Obtained.

| MATOZOA.                   |                   |                            |                   | DENSITY OF SEMEN (MILLIONS OF SPERM PER C.MM.). |                  |                              |                  | HYDROGEN-ION CONCENTRATION. |                           |                          |                           | EXAMINATIONS OF MORPHOLOGY. |                         |                         |                         | TESTS FOR FERTILIZING POWER. |                         |  |  |
|----------------------------|-------------------|----------------------------|-------------------|---|------------------|------------------------------|------------------|-----------------------------|---------------------------|--------------------------|---------------------------|-----------------------------|-------------------------|-------------------------|-------------------------|------------------------------|-------------------------|--|--|
| 72 Hours <i>in vitro</i> . |                   | 96 Hours <i>in vitro</i> . |                   | Rough Estimate.                                 |                  | Dry Films of Semen Examined. |                  | Haemocytometer Counts.      |                           | B.D.H. Capillator Tests. |                           | Beckman's pH Meter Tests.   |                         | Wet Preparations.       |                         | Stained Dry Films.           |                         | Number of Inseminations in the First and Third Series that could be tested for fertilizing power of specific Sperms. | Percentage of Inseminations followed by fertility (excluding all cases in which no Eggs were set or Sperms were superseded by other Sperms present). |
| Number of Tests.           | Average Motility. | Number of Tests.           | Average Motility. | Number of Tests.                                | Average Density. | Number of Tests.             | Average Density. | Number of Tests.            | Average pH Concentration. | Number of Tests.         | Average pH Concentration. | Number of Examinations.     | Microscopical Findings. | Number of Examinations. | Microscopical Findings. | Number of Examinations.      | Microscopical Findings. |  |  |
| Col. (16)                  | Col. (17)         | Col. (18)                  | Col. (19)         | Col. (20)                                       | Col. (21)        | Col. (22)                    | Col. (23)        | Col. (24)                   | Col. (25)                 | Col. (26)                | Col. (27)                 | Col. (28)                   | Col. (29)               | Col. (30)               | Col. (31)               | Col. (32)                    | Col. (33)               | Column (34)  | Column (35)  |
| 1                          | 0.0               | 1                          | 0.1               | 5   | 5.0              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | 15                      | n/u.                    | —                            | —                       | 8  | 63%  |
| 1                          | 0.1               | 1                          | 0.0               | 17  | 4.5              | —                            | —                | 2                           | 5.5                       | 4                        | 7.3                       | —                           | —                       | 6                       | n/u.                    | 4                            | n/u.                    | 15   | 80%  |
| —                          | —                 | —                          | —                 | 26  | 5.0              | 2                            | 8.5              | 1                           | 6.1                       | —                        | —                         | 1                           | 7.72                    | 3                       | n/u.                    | 42                           | n/u.                    | 30   | 40%  |
| —                          | —                 | —                          | —                 | 13  | 4.9              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | 1                       | n/u.                    | 5                            | n/u.                    | 6  | 66%  |
| —                          | —                 | —                          | —                 | 12  | 5.5              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | 2                       | n/u.                    | 3                            | n/u.                    | 6  | 80%  |
| —                          | —                 | —                          | —                 | 2   | 3.1              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | 1                            | n/u.                    | 0  | —  |
| —                          | —                 | —                          | —                 | 3   | 4.0              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 1  | 100%   |
| —                          | —                 | —                          | —                 | 1   | 1.0              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 0  | —  |
| —                          | —                 | —                          | —                 | 7   | 1.0              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | 4                       | abn.(1)                 | 6                            | abn.(2)                 | 2  | 100%   |
| —                          | —                 | —                          | —                 | 4   | 3.3              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 2  | —  |
| —                          | —                 | —                          | —                 | 6   | 3.8              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 4  | 50%  |
| —                          | —                 | —                          | —                 | 3   | 2.0              | 2                            | —                | 2                           | 4.7                       | —                        | —                         | 1                           | 7.51                    | 1                       | n/u.                    | 6                            | n/u.                    | 8  | 50%  |
| —                          | —                 | —                          | —                 | 2   | 2.0              | —                            | —                | 1                           | 1.35                      | —                        | —                         | 1                           | —                       | 1                       | n/u.                    | 4                            | n/u.                    | 1  | 0%   |
| —                          | —                 | —                          | —                 | 4   | 3.3              | —                            | —                | 4                           | 3.6                       | —                        | —                         | 1                           | 7.00                    | 1                       | n/u.                    | 19                           | n/u.                    | 2  | 50%  |
| —                          | —                 | —                          | —                 | 7   | 1.0              | —                            | —                | 8                           | 6.2                       | 2                        | 7.25                      | —                           | —                       | 8                       | n/u.                    | 2                            | n/u.                    | 3  | 0%   |
| —                          | —                 | —                          | —                 | 16  | 1.2              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | 19                           | n/u.                    | 7  | 58%  |
| —                          | —                 | —                          | —                 | 15  | 4.0              | —                            | —                | 6                           | 7.9                       | —                        | —                         | —                           | —                       | 2                       | abn.(3)                 | 19                           | abn.(4)                 | 15   | 40%  |
| —                          | —                 | —                          | —                 | 19  | 4.5              | —                            | —                | 1                           | 4.2                       | 4                        | 7.2                       | —                           | —                       | —                       | —                       | 11                           | abn.(5)                 | 18   | 33%  |
| —                          | —                 | —                          | —                 | 13  | 4.5              | —                            | —                | 1                           | 3.5                       | —                        | —                         | 1                           | 7.74                    | 4                       | n/u.                    | 4                            | n/u.                    | 6  | 50%  |
| —                          | —                 | —                          | —                 | 16  | 4.0              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | 15                      | n/u.                    | 3                            | n/u.                    | 7  | 58%  |
| 1                          | 0.1               | —                          | —                 | 2   | 3.3              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | 1                            | n/u.                    | 0  | —  |
| —                          | —                 | —                          | —                 | 7   | 3.5              | —                            | —                | 1                           | 4.35                      | 4                        | 7.2                       | —                           | —                       | 1                       | n/u.                    | 6                            | n/u.                    | 6  | 17%  |
| —                          | —                 | —                          | —                 | 12  | 3.0              | —                            | —                | 1                           | 3.9                       | —                        | —                         | 1                           | 7.47                    | —                       | —                       | 5                            | n/u.                    | 1  | 0%   |
| —                          | —                 | —                          | —                 | 12  | 2.0              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | 4                            | n/u.                    | 4  | 25%  |
| —                          | —                 | —                          | —                 | 7   | 1.5              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | 2                       | n/u.                    | 7                            | n/u.                    | 10   | 0%   |
| —                          | —                 | —                          | —                 | 13  | 0.7              | —                            | —                | 1                           | 1.5                       | —                        | —                         | —                           | —                       | 1                       | n/u.                    | 7                            | n/u.                    | 3  | 0%   |
| —                          | —                 | —                          | —                 | 10  | 1.3              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | 1                       | n/u.                    | 2                            | n/u.                    | 1  | 100%   |
| —                          | —                 | —                          | —                 | 1   | 3.8              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 1  | 100%   |
| —                          | —                 | —                          | —                 | 10  | 3.8              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 7  | 42%  |
| —                          | —                 | —                          | —                 | 1   | 3.8              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 4  | 0%   |
| —                          | —                 | —                          | —                 | 9   | 3.5              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | 3                            | n/u.                    | —  | —  |
| —                          | —                 | —                          | —                 | 1   | 4.5              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 2  | 50%  |
| —                          | —                 | —                          | —                 | 2   | 3.0              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | —  | —  |
| —                          | —                 | —                          | —                 | 1   | 2.1              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 3  | 0%   |
| —                          | —                 | —                          | —                 | 1   | 2.5              | —                            | —                | —                           | —                         | —                        | —                         | —                           | —                       | —                       | —                       | —                            | —                       | 3  | 0%   |

ny sperm with curled up heads in all specimens; (4) and (5), many sperm with curled up heads in some specimens.



TABLE 46.  
*The Samples of Semen from Different Donors used in the First Series of Intra-peritoneal Inseminations.*

| Line. | Number given to each Cock. | Breed of Cock.                 | Number of Cases of Insemination performed. | Number of Cases followed by Eggs which were set. | Percentage of such Inseminations followed by Fertile Eggs. | Number of Cases followed by Eggs Fertilized by Sperm; Semen of an unidentified Cock. | Number of Cases followed by Eggs Fertilized by Sperm; Semen present in the Hen at the same time. | Number of Cases followed by Eggs Fertilized by own Sperm; Semen was introduced at the same time. | Number of Cases followed by Fertile Eggs when no other Semen was introduced at the same time. |
|-------|----------------------------|--------------------------------|--|--|--|--|--|--|---|
|       | Column (1)                 | Column (2)                     | Column (3)                                 | Column (4)                                       | Column (5)   | Column (6)   | Column (7)   | Column (8)   | Column (9)  |
| a     | 6                          | Intra-peritoneal Insemination: | 62   | 49   | 67%  | 9  | 6  | 7  | 10  |
| b     | 14                         | W.L.....                       | 2  | 0  | 100%   | 0  | 0  | 0  | 1   |
| c     | 18                         | S.A.A.....                     | 2  | 1  |  |  |  |  |   |
|       |                            | Bd.P.R.....                    |  |  |  |  |  |  |   |
| d     | 23                         | W.L.....                       | 3  | 2  | 100%   | 1  | 0  | 0  | 1   |
| e     | 33                         | Bd.P.R.....                    | 4  | 2  | 100%   | 0  | 2  | 0  | 0   |
| f     | 34                         | Bd.P.R.....                    | 8  | 6  | 50%  | 1  | 0  | 0  | 0   |
| g     | 37                         | W.L.....                       | 2  | 2  | 50%  | 1  | 0  | 0  | 0   |
| h     | 38                         | R.I.R.....                     | 28   | 21   | 56%  | 6  | 1  | 3  | 2   |
| i     | 44                         | Bd.P.R.....                    | 30   | 28   | 46%  | 7  | 1  | 1  | 3   |
| k     | 47                         | Wyandotte.....                 | 14   | 11   | 63%  | 1  | 3  | 0  | 0   |
| l     | 48                         | S.A.A.....                     | 2  | 0  | 100%   | 0  | 1  | 0  | 1   |
|       | 53                         | Bd.P.R.....                    | 2  | 2  |  |  |  |  |   |
| m     | 6                          | Insemination per Vaginum:      | 9  | 7  | 86%  | 1  | 0  | 3  | 1   |
| n     | 33                         | W.L.....                       | 2  | 2  | 100%   | 0  | 2  | 0  | 0   |
| o     | 34                         | Bd.P.R.....                    | 3  | 2  | 50%  | 1  | 1  | 0  | 0   |
| p     | 37                         | W.L.....                       | 1  | 1  | 0%   | 0  | 0  | 0  | 0   |
| q     | 38                         | R.I.R.....                     | 3  | 2  | 50%  | 1  | 0  | 0  | 1   |
| r     | 44                         | Bd.P.R.....                    | 5  | 4  | 50%  | 1  | 0  | 0  | 1   |
| s     | 47                         | Wyandotte.....                 | 1  | 1  | 100%   | 0  | 0  | 0  | 1   |
| t     | 53                         | Bd.P.R.....                    | 1  | 1  | 100%   | 0  | 1  | 0  | 0   |

TABLE 47.  
*The Fertility Obtained with Samples of Semen from Different Donors used in the First Series of Inseminations.*

| Line. | Number given to each Cock. | Number of Cases of Insemination. | Number of Cases followed by Eggs only Fertilized by Sperms from own Semen. | Number of Eggs laid after Insemination that were set. | Percentage of Eggs proved Fertile. | Number of Eggs laid Ten Days after Insemination that were set. | Percentage of Eggs laid Ten Days after Insemination that were proved Fertile. | Average duration of Fertile period in days after Insemination. |
|-------|----------------------------|----------------------------------|--|---|------------------------------------|--|---|--|
|       | Column (1)                 | Column (2)                       | Column (3)   | Column (4)  | Column (5)                         | Column (6)   | Column (7)  | Column (8)   |
|       |                            | Intraperitoneal Insemination:—   |  |   |                                    |  |   |  |
| a     | 6                          | 62.....                          | 17   | 419   | 29%                                | 170  | 41%   | 13   |
| b     | 14                         | 2.....                           | 0  | 14  | 21%                                | 4  | 75%   | 5  |
| c     | 18                         | 2.....                           | 1  |   |                                    |  |   |  |
| d     | 23                         | 3.....                           | 1  | 6   | 17%                                | 5  | 20%   | 2  |
| e     | 33                         | 4.....                           | 0  | 38  | 15%                                | 23   | 24%   | 7  |
| f     | 34                         | 8.....                           | 2  |   |                                    |  |   |  |
| g     | 37                         | 2.....                           | 0  | 5   | 0%                                 |  |   |  |
| h     | 38                         | 28.....                          | 5  | 133   | 28%                                | 66   | 26%   | 14   |
| i     | 44                         | 30.....                          | 4  | 147   | 11%                                | 67   | 19%   | 10   |
| j     | 47                         | 14.....                          | 3  | 58  | 12%                                | 33   | 18%   | 8  |
| k     | 48                         | 2.....                           | 0  | 9   |                                    | 1  |   |  |
| l     | 53                         | 2.....                           | 1  |   | 22%                                |  | 100%  | 11   |
|       |                            | Insemination per Vaginum:—       |  |   |                                    |  |   |  |
| m     | 6                          | 9.....                           | 4  | 67  | 39%                                | 22   | 76%   | 16   |
| n     | 33                         | 2.....                           | 0  |   |                                    |  |   |  |
| o     | 34                         | 3.....                           | 0  |   |                                    |  |   |  |
| p     | 37                         | 1.....                           | 0  | 4   | 0%                                 |  |   |  |
| q     | 38                         | .....                            | 0  | 1   | 0%                                 |  |   |  |
| r     | 44                         | 5.....                           | 1  | 23  | 39%                                | 13   | 54%   | 13   |
| s     | 47                         | 1.....                           | 1  | 8   | 37%                                | 4  | 75%   | 9  |
| t     | 53                         | 1.....                           | 0  | 3   | 0%                                 |  |   |  |

TABLE 48.

The Hatchability of Fertile Eggs Obtained with Semen from the Different Donors used in the First Series of Inseminations.

| Line.                         | Number given to each Cock. | Number of Cases of Insemination performed. | Number of Cases followed by Eggs only Fertilized by Sperms from own Semen. | Number of Eggs proved Fertile. | Percentage of Fertile Eggs which Hatched. | Percentage of Fertile Eggs with Chicks dead in Shell. | Percentage of Fertile Eggs with dead Embryos. | Number of Eggs laid Ten Days after Insemination that were proved Fertile. | Percentage of Fertile Eggs laid Ten Days after Insemination that Hatched. | Average duration of Hatchability in days after Insemination. |
|-------------------------------|----------------------------|--|--|--------------------------------|---|---|---|---|---|--|
| Intraperitoneal Insemination: |                            |  |  |                                |   |   |   |   |   |  |
| a                             | 6                          | Column (1)<br>62                           | Column (3)<br>17   | Column (4)<br>120              | Column (5)<br>56%                         | Column (6)<br>16%                                     | Column (7)<br>26%                             | Column (8)<br>70  | Column (9)<br>59%   | Column (10)<br>11  |
| b                             | 14                         | 2  | 0  | 3                              | 100%                                      | —   | —   | 3   | 100%  | 5  |
| c                             | 18                         | 2  | 1  | 1                              | 100%                                      | —   | —   | 1   | 100%  | 2  |
| d                             | 23                         | 3  | 1  | 6                              | 83%                                       | 17%   | —   | 6   | 83%   | 7  |
| e                             | 33                         | 4  | 0  | —                              | —   | —   | —   | —   | —   | —  |
| f                             | 34                         | 8  | 2  | —                              | —   | —   | —   | —   | —   | —  |
| g                             | 37                         | 2  | 0  | —                              | —   | —   | —   | —   | —   | —  |
| h                             | 38                         | 28   | 5  | 37                             | 40%                                       | 11%   | 49%   | 17  | 30%   | 9  |
| i                             | 44                         | 30   | 4  | 16                             | 38%                                       | —   | 62%   | 13  | 39%   | 9  |
| j                             | 47                         | 14   | 3  | 7                              | 42%                                       | —   | 58%   | 6   | 50%   | 3  |
| k                             | 48                         | 2  | 0  | 2                              | 100%                                      | —   | —   | 1   | 100%  | 11   |
| l                             | 53                         | 2  | 1  | —                              | —   | —   | —   | —   | —   | —  |
| Insemination per Vaginum:     |                            |  |  |                                |   |   |   |   |   |  |
| m                             | 6                          | 9  | 4  | 26                             | 38%                                       | 27%   | 35%   | 17  | 48%   | 9  |
| n                             | 33                         | 2  | 0  | —                              | —   | —   | —   | —   | —   | —  |
| o                             | 34                         | 3  | 0  | —                              | —   | —   | —   | —   | —   | —  |
| p                             | 37                         | 1  | 0  | —                              | —   | —   | —   | —   | —   | —  |
| q                             | 38                         | 3  | 0  | —                              | —   | —   | —   | —   | —   | —  |
| r                             | 44                         | 5  | 1  | 9                              | 78%                                       | —   | 22%   | 7   | 86%   | 13   |
| s                             | 47                         | 1  | 1  | 3                              | 100%                                      | —   | —   | 3   | 100%  | 4  |
| t                             | 53                         | 1  | 0  | —                              | —   | —   | —   | —   | —   | —  |

TABLE 49.  
The Fertility Resulting from Insemination in Fowl Hens with Different Amounts of Semen.

| Line. | Size of Dose of Semen Introduced.                        | Number of Cases of Insemination performed. | Number of Cases of Insemination followed by Eggs that were set. | Percentage of Cases followed by Fertility. | Number of Eggs laid after Insemination that were set. | Percentage of such Eggs proved to have been Fertile. | Eggs laid 24 hours to Ten Days after Insemination that were set. | Percentage of Eggs laid Ten Days after Insemination that were proved Fertile. | Average duration of Fertility in days after Insemination. |
|-------|--|--|---|--|---|--|--|---|---|
|       |  | Column (2)                                 | Column (3)  | Column (4)                                 | Column (5)  | Column (6)   | Column (7)   | Column (8)  | Column (9)  |
|       | Column (1)   | Column (2)                                 | Column (3)  | Column (4)                                 | Column (5)  | Column (6)   | Column (7)   | Column (8)  | Column (9)  |
|       | Pure, fresh semen, not mixed and given in a single dose: |  |   |  |   |  |  |   |   |
| a     | 0.01-0.09 ml.....  | 3  | 2   | 100%                                       | 18  | 17%  | 10   | 30%   | 3   |
| b     | 0.1 ml.....  | 28   | 26  | 46%  | 259   | 19%  | 106  | 29%   | 8.7   |
| c     | 0.15-0.25 ml.....  | 15   | 9   | 77%  | 81  | 38%  | 35   | 56%   | 10.6  |
| d     | 0.3-0.5 ml.....  | 11   | 7   | 100%                                       | 58  | 39%  | 32   | 53%   | 8.0   |
| e     | 0.75 ml.....   | 2  | 0   | —  | —   | —  | —  | —   | —   |
|       | Pure, fresh, semen, mixed or given in multiple doses:    |  |   |  |   |  |  |   |   |
| f     | 0.01-0.09 ml.....  | 3  | 0   | —  | —   | —  | —  | —   | —   |
| g     | 0.1 ml.....  | 10   | 8   | 12%  | 66  | 8%   | 25   | 20%   | 9   |
| h     | 0.15-0.25 ml.....  | 13   | 8   | 75%  | 79  | 27%  | 24   | 50%   | 11.5  |
| i     | 0.3-0.5 ml.....  | 15   | 13  | 92%  | 135   | 33%  | 76   | 41%   | 9   |
| j     | 0.6-0.9 ml.....  | 1  | 1   | 100%                                       | 11  | 100%   | 8  | 100%  | 13  |
| k     | 1.0-1.5 ml.....  | 10   | 7   | 72%  | 57  | 61%  | 15   | 100%  | 21  |

TABLE 50.  
*The Hatchability of Fowl Eggs Fertilized from Intraperitoneal Insemination with Different Amounts of Semen.*

| Line. | Size of Dose of Semen Introduced.                         | Number of Cases of Insemination performed. | Number of Eggs proved Fertile. | Percentage of Fertile Eggs which Hatched. | Percentage of Eggs with Chicks dead in Shell. | Percentage of Eggs with dead Embryos. | Number of Eggs laid Ten Days after Insemination that proved Fertile. | Percentage of Fertile Eggs laid Ten Days after Insemination that Hatched. | Average duration of Hatchability in days after Insemination. |
|-------|---|--|--------------------------------|---|---|---------------------------------------|--|---|--|
|       | Column (1)  | Column (2)                                 | Column (3)                     | Column (4)                                | Column (5)                                    | Column (6)                            | Column (7)   | Column (8)  | Column (9)   |
| a     | Pure, fresh semen, not mixed and given in a single dose:— | 3  | 3                              | 67%                                       | 33%   | 0%                                    | 3  | 67%   | 2.5  |
| b     | 0.01-0.09 ml.....   | 28   | 48                             | 50%                                       | 19%   | 31%                                   | 33   | 61%   | 6.0  |
| c     | 0.1 ml.....   | 15   | 32                             | 78%                                       | 12%   | 10%                                   | 19   | 75%   | 8.1  |
| d     | 0.15-0.25 ml.....   | 11   | 23                             | 48%                                       | 22%   | 30%                                   | 17   | 59%   | 4.6  |
| e     | 0.3-0.5 ml.....   | 2  | 0                              | —   | —   | —                                     | —  | —   | —  |
|       | 0.75 ml.....  |  |                                |   |   |                                       |  |   |  |
| f     | Pure, fresh Semen, mixed or given in multiple doses:      | 3  | 0                              | —   | —   | —                                     | —  | —   | —  |
| g     | 0.01-0.09 ml.....   | 10   | 5                              | 20%                                       | 0%  | 80%                                   | 5  | 20%   | 2  |
| h     | 0.1 ml.....   | 13   | 21                             | 42%                                       | 9%  | 49%                                   | 12   | 42%   | 6.5  |
| i     | 0.15-0.25 ml.....   | 15   | 45                             | 60%                                       | 7%  | 33%                                   | 31   | 67%   | 6.7  |
| j     | 0.3-0.5 ml.....   | 1  | 11                             | 36%                                       | 36%   | 28%                                   | 8  | 50%   | 8.0  |
| k     | 0.6-0.9 ml.....   | 10   | 35                             | 33%                                       | 31%   | 36%                                   | 15   | 27%   | 21   |
|       | 0.99-1.5 ml.....  |  |                                |   |   |                                       |  |   |  |

TABLE 58.  
*Analysis of Simultaneous Inseminations by Different Methods and Routes. (Successful Inseminations given in Heavy Type.)*

| Line. | Class of Inseminations.   | Serial Number of the operation. | DETAILS OF INSEMINATIONS.  |                  |                       |                                     |  |                            |                  |               |                                |   | Remarks on Classes of Inseminations.   |                 |
|-------|---|---------------------------------|----------------------------|------------------|-----------------------|-------------------------------------|--|----------------------------|------------------|---------------|--------------------------------|---|--|-----------------|
|       |   |                                 | Intraperitoneal.           |                  |                       |                                     |  | Per Vaginum.               |                  |               |                                |   |  | Natural Mating. |
|       |   |                                 | Number given to the Cocks. | Amount of Semen. | Depth of penetration. | Syringe used.                       | Needle used.                                 | Number given to the Cocks. | Amount of Semen. | Syringe used. | Description of Cocks.          |   |  |                 |
| a     | Column (1)  | Column (2)                      | Column (3)                 | Column (4)       | Column (5)            | Column (6)                          | Column (7)                                   | Column (8)                 | Column (9)       | Column (10)   | Column (11)                    | Column (12)   | Spermatozoa from the semen of cock No. 6, consistently superseded the spermatozoa of cocks Nos. 33 and 53; and spermatozoa of cock No. 38 superseded those of No. 34, notwithstanding excessive contact between semen and metal. |                 |
| b     | Inseminations with equal amounts of pure semen by different artificial methods..... | 21                              | 33                         | 0.1 ml.          | 6.0 cm.               | All-glass.....                      | Metal, coarse, sharp, and single aperture    | 6                          | 0.1 ml.          | All-glass...  | —                              | —   |  |                 |
| c     |   | 22                              | 6                          | 0.1 ml.          | 6.0 cm.               | All-glass.....                      | Metal, coarse, sharp, and single aperture    | 33                         | 0.1 ml.          | All-glass...  | —                              | —   |  |                 |
| d     |   | 24                              | 6                          | 0.2 ml.          | 6.0 cm.               | All-glass.....                      | Metal, coarse, sharp, and single aperture    | 33                         | 0.2 ml.          | All-glass...  | —                              | —   |  |                 |
| e     |   | 118                             | 53                         | 0.1 ml.          | 6.0 cm.               | All-glass, special with long nozzle | —  | 6                          | 0.1 ml.          | All-glass...  | —                              | —   |  |                 |
| f     |   | 44                              | 38                         | 0.1 ml.          | 6.0 cm.               | Metal piston in syringe             | Metal, coarse, sharp, and single aperture    | 34                         | 0.1 ml.          | All-glass...  | —                              | —   | Sperms of No. 6 able to maintain superiority via the oviduct even at half the volume of semen.   |                 |
| g     | Inseminations with different amounts of pure semen by all methods.....              | 27                              | 53                         | 0.2 ml.          | 6.0 cm.               | All-glass.....                      | Metal, coarse, sharp, and single aperture    | 6                          | 0.1 ml.          | All-glass...  | —                              | —   |  |                 |
| h     |   | 111                             | 6                          | 0.4 ml.          | 4.0 cm.               | All-glass.....                      | Metal, coarse, sharp, and single aperture    | —                          | —                | —             | Recessive coloured flock cocks | Spermatozoa from the No. 6 immediately superseded those of the flock males, but sperms from No. 47 failed to do so. |  |                 |
| i     |   | 116                             | 47                         | 0.1 ml.          | 6.0 cm.               | All-glass, special with long nozzle | —  | —                          | —                | —             | Recessive coloured flock cock  |   |  |                 |
| j     |   | 120                             | 6                          | 0.05 ml.         | 4.0 cm.               | All-glass, special with long nozzle | —  | —                          | —                | —             | Recessive coloured flock cocks |   |  |                 |
| k     | Inseminations with different amounts of mixed semen by different methods.....       | 73                              | 6                          | 0.05 ml.         | 6.0 cm.               | Metal nozzle and piston             | Metal, coarse, sharp, and single aperture    | —                          | —                | —             | Recessive coloured flock cocks | Sperms from No. 6 and No. 44, when mixed, could not supersede those from the flock cocks.                           |  |                 |
|       |   | 74                              | 44                         | 0.05 ml.         | 6.0 cm.               | Metal nozzle and piston             | Metal, fine, blunt, long and single aperture | —                          | —                | —             | Recessive coloured flock cock  |   |  |                 |

TABLE 59.  
Summary of the Results of Insemination in Fowls During the First and Third Series of Inseminations done in the Present Work.

| Line.                          | Class of Dosage.             | Method of Insemination.                                   | Number of Cases of Insemination performed (simultaneous operations taken as one case). | Number of Cases of Insemination with Fertile Eggs from identified spermatozoa | Number of Cases of Insemination with Fertile Eggs all fertilized by Sperms from one Cock only. | Number of Cases of Insemination with Fertile Eggs fertilized by Sperms from different Cocks. | Remarks on Paternity.  | Remarks on Paternity. |   |
|--------------------------------|------------------------------|---|--|---|--|--|--|-----------------------|---|
| FIRST SERIES OF INSEMINATIONS. |                              |   |  |   |  |  |  |                       |   |
| a                              | Column (1)<br>Unmixed alone. | Column (2)<br>Intraperitoneal.....                        | Column (3)<br>53   | Column (4)<br>25  | Column (5)<br>35   | Column (6)<br>35   | Column (7)   | Column (8)            | Column (9)  |
| b                              | Unmixed alone.               | <i>Per Vaginum</i> .....                                  | 9  | 3   | 3  | 3  | —  | —                     | —   |
| c                              | Mixed.....                   | Intraperitoneal.....                                      | 31   | 3   | 3  | 3  | {<br>1 from No. 6, mixed with No. 22.....<br>1 from No. 38, mixed with No. 6.....<br>1 from No. 38, mixed with Nos. 6 and 44               | {<br>0                | —   |
| d                              | Mixed.....                   | <i>Per Vaginum</i> .....                                  | 2  | 0   | —  | —  | —  | —                     | —   |
| e                              | Separate.....                | Intraperitoneal method alone..                            | 7  | 4   | 4  | 4  | {<br>2 from No. 6, Tables: 55 and 57.....<br>1 from No. 38, see Table 56.....<br>1 from No. 44, see Table 54.....                          | {<br>0                | —   |
| f                              | Separate.....                | <i>Per Vaginum</i> and intraperitoneal and natural mating | 17   | 11  | 11   | 11   | {<br>7 from Cock Number 6.....<br>1 from No. 38, see Table 58.....<br>3 from flock males: Table 58.....                                    | {<br>0                | —   |
| THIRD SERIES OF INSEMINATIONS. |                              |   |  |   |  |  |  |                       |   |
| g                              | Unmixed alone.               | Intraperitoneal.....                                      | 25   | 2   | 2  | 2  | —  | —                     | —   |
| h                              | Unmixed alone.               | <i>Per Vaginum</i> .....                                  | 8  | 1   | 1  | 1  | —  | —                     | —   |
| i                              | Mixed.....                   | Intraperitoneal.....                                      | 15   | 4   | 3  | 2  | {<br>1 from No. 6, mixed with 38, 47 and 53.<br>1 from No. 47, mixed with Nos. 53, 55,<br>and superseded by natural 36.....                | {<br>1                | {<br>Double paternity: Nos. 6, 47 and 61.<br>Third and Fifth day chicks from No. 6;<br>Sixth day chick from No. 61. |
| j                              | Mixed.....                   | <i>Per Vaginum</i> .....                                  | 5  | 4   | 4  | 3  | {<br>1 from No. 6, mixed with No. 47, 53 & 55<br>1 from No. 53, mixed with Nos. 6 and 47<br>1 from No. 53, mixed with No. 55.....          | {<br>1                | {<br>Double paternity: Nos. 6, 55, and 61:<br>First day from number 6; and second<br>day a chick from No. 61.       |
| k                              | Separate.....                | Intraperitoneal method alone..                            | 8  | 2   | 1  | 1  | 1 from No. 6, done separately with No. 53  | 0                     | —   |
| l                              | Separate.....                | Various methods.....                                      | 6  | 5   | 5  | 4  | {<br>3 from No. 47, done separately with No.<br>53 and 55.....<br>1 from No. 53, mixed with No. 55 and<br>done separately with No. 47..... | {<br>(1)              | {<br>Not proper double but case of simple<br>supersession as already shown in line i,<br>Column (7).                |

## APPENDIX.

C.—THE POST MORTEM EXAMINATIONS OF THE GENITALIA OF FOWL HENS.  
(Tables 60, 61 and 64.)

The fullest possible information on the results of investigations into the distribution of spermatozoa in the hen, is presented in this appendix. A fuller account of post mortem examinations in chronological order would overstrain the most patient reader and is not justified even for reference purposes. The tables are self-explanatory and have been summarized in the corresponding tables in the text.

TABLE 60.

*The Results of Microscopical Examination of Scrapings from the Genital Organs of Hens 24 hours after Insemination by Diff*

| ITEM.  |  | MATERIAL AND RESULTS.   |
|--|--|---|
| Number of bird.....                          | No. 4  | No. 7   |
| Age of bird.....                             | Two year old   | Two year old  |
| Breed of bird.....                           | Barred Plymouth Rock   | Barred Plymouth Rock  |
| Laying history.....                          | Very good layer as pullet (112, 2 oz. eggs in 122 days). Broke down during second year with Penguin like abdomen | Fair layer. Culled on constitutional points.....  |
| Mating history.....                          | Continuously mated with cocks in run during second year.....   | Four controlled natural copulations on the 25th, 14th and 8th day and at 24 hours before death  |
| Interval between mating and death.....       | 24 hours after separation.....   | 24 hours after copulation.....  |
| Macroscopical appearances.....               | Ovary active, several large follicles. Condition: over fat.....  | Ovary active. Shelled egg in Uterus: Whiter shell and 4.0 gm. less in weight than the previous three eggs   |
| Microscopical results: Ovary.....            | One tailless spermatozoon head seen.....   | No sperm found in scrapings of calyx, or small follicles or large follicle surface  |
| Infundibulum.....                            | No sperm seen.....   | Very numerous spermatozoa. Staining faintly and tails not clearly visible   |
| (a) Anterior.....                            | (a) Not examined.....  | (a) Group of swollen tailless sperm heads. Few singly with short tails  |
| (b) Middle.....                              | (b) No sperm seen.....   | (b) No sperm seen.....  |
| (c) Posterior-albumen secreting portion..... | (c) Not examined.....  | (c) No sperm seen.....  |
| Isthmus.....                                 | No sperm seen.....   | A few faintly staining tailless sperms seen.....  |
| Uterus.....                                  | No sperm seen.....   | No sperm seen.....  |
| Vagina.....                                  | No sperm seen.....   | Numerous sperms with normal heads and various lengths of tails; single sperms have long tails, but in denser groups near epithelium the short tailed and tailless forms are more common |
| Cloaca.....                                  | One spermatozoa with fairly long tail found.....   | Clump of numerous tailless sperms, sinuous shape, staining well also similar single forms   |
| Remarks.....                                 | Poor receptivity and unpopularity with the cocks was considered possible in this case                            | It is unlikely that the upper sperm swarm was from the copulation eight days previously   |



Table 60 (Appendix) shows the results obtained with dry stained smears of scrapings from the mucosa of the oviduct of four hens early in the work and twenty-four hours after insemination or separation from the male.

The results from the application of different techniques for search and at different times after insemination, is shown in Table 61 (Appendix) which is a record of very detailed and painstaking search in nine post mortem examinations, performed during the third series of inseminations.

Examination of the genital tract both before and after death was practised with the aid of anaesthesia in the fourth series of inseminations, from which the results are shown clearly in Table 64 (Appendix).

TABLE 60. *cont.**Different Methods and the Location of Spermatozoa in the Organs of the Hen.*

|  |  |
|--|--|
| No. 12<br>Ten month pullet<br>Rhode Island Red   | No. 11<br>Eight months old pullet<br>Buff Plymouth Rock  |
| Just starting to lay (late hatched bird).....  | Just starting to lay (late hatched bird).  |
| Artificially inseminated <i>per vaginam</i> (Burrows & Quinn, 1939) 28 days after separation from the cock: Semen 0.3 c.c. fresh from cock No. 6 | Artificially inseminated by intraperitoneal injection of semen on the 16th day and 24 hours prior to death: Semen 0.25 c.c fresh from cock No. 6.  |
| 24 hours after insemination <i>per vaginam</i> .....   | 24 hours after intraperitoneal insemination.   |
| Ovary active yolk (ovum) in anterior albumen secreting portion   | Ovary active, some strands of albumen surrounding follicles. Ruptured shell membrane and mass of albumen all along oviduct. No trace of the ovum of this broken egg was found anywhere in the body of the hen. |
| No sperm found in surface scrapings from large follicles and calyx   | No sperm found in smears from surface of small and large follicles: numerous multinuclear cells.   |
| No sperm seen.....   | Many faintly staining sperm heads.   |
| (a) No spermatozoa found on mucous membrane nor on surface of yolk   | (a) No sperm seen.   |
| (b) No spermatozoa seen.....   | (b) No sperm seen.   |
| (c) Several indistinct faintly staining tailless sperms.....   | (c) No sperm seen.   |
| Several indistinct faintly staining tailless sperms.....   | No sperm seen.   |
| No sperm seen.....   | No sperm seen.   |
| Numerous faintly staining sperm heads.....   | No sperm seen.   |
| Soiled, unsuitable.....  | No sperm seen.   |
| Spermatozoa only halfway up the oviduct; Insemination <i>per vaginam</i> done with hard shelled egg in uterus shortly before laying              | Sperms obviously entered the duct from the cranial side. The inflammatory changes possibly interfered.   |



Table 61

|   |  |                                  |
|---|--|----------------------------------|
| Interval between insemination and slaughter of Birds..... | Five minutes.  |                                  |
| Number of Bird.....                                       | 51.  |                                  |
| Age and Breed of Bird.....                                | W.L. Pullet.   |                                  |
| Production history of Bird.....                           | Not laying.  |                                  |
| Details of insemination.....                              | { Amount of Semen..... 0.4 c.c.<br>Donor of Semen..... Cocks Nos. 6 and 55.<br>Method of insemination... <i>Per vaginam</i> : 0.2 c.c. of No. 6.<br>Intraperitoneal: 0.2 c.c. of No. 55. |                                  |
| Macroscopical findings.....                               | Nothing unusual.   |                                  |
| Microscopical findings and Method of examination:—        | With Ringer's solution and Capillary action.   | Dry film and Giemsa's stain (a). |
| (i) Intestinal surface.....                               | — L  | ×                                |
| (ii) Ovary.....   | { Calyces..... ×<br>Large follicles..... ×<br>Small follicles..... ×   | { ×<br>—<br>×                    |
| (iii) Infundibulum.....                                   | { Fimbria..... ×<br>Cranial..... ×<br>Middle..... ×<br>Caudal..... — C   | { ×<br>×<br>— CD<br>— D          |
| (iv) Albumen region.....                                  | { Cranial..... ×<br>Middle..... —<br>Caudal..... ×   | { ×<br>—<br>×                    |
| (v) Isthmus.....  | { Cranial..... ×<br>Middle..... —<br>Caudal..... ×   | { ×<br>—<br>×                    |
| (vi) Uterus.....  | —  | —                                |
| (vii) Vagina.....   | —  | ×                                |
| (viii) Cloaca.....  | —  | ×                                |

209-210a

209-210b



Table 61 cont.

Summary of the Re

|   |   |   |   |   |  |   |
|---|---|---|---|---|--|---|
| Two hours.<br>20.<br>White Leghorn Pullet.<br>In active production.<br>0.5 c.c.<br>Mixed semen from Cocks Nos. 47 and 53.<br>Intraperitoneal with glass syringe and coarse sharp, long<br>needle. |   |   |   | Three days,<br>30.<br>White Leghorn Pullet.<br>Laid no eggs for twelve days.<br>0.3 c.c.<br>From Cocks No. 37.<br>Per vaginam with glass syringe. |  |   |
| Shelled egg in uterus and encapsulated ovum in peritoneal<br>cavity.  |   |   |   | Ovary active and many large follicles.  |  |   |
| With Ringer's<br>solution and<br>Capillary<br>action.   | Dry film with<br>Carbol Fuchsin<br>and Eosin (b).   | Dry film with<br>Carbol acid<br>Fuchsin (c).  | Dry film with<br>Giemsa's stain<br>(a).   | With Ringer's<br>solution and<br>Platinum loop.   | Dry film with<br>Giemsa's<br>stain (a).  | Dry film with<br>Nile-blue-<br>sulphate (d).                                      |
| —<br><br>×<br>—<br>×<br><br>—<br>+++++<br>+++++<br>+++++<br><br>++<br>×<br>++++<br><br>—<br>—<br>×<br><br>—<br><br>×<br><br>×   | —<br><br>×<br>—<br>×<br><br>—<br>+<br>++<br>×<br><br>00<br>×<br>0<br><br>×<br>—<br>×<br><br>—<br><br>×<br><br>× | —<br><br>×<br>—<br>×<br><br>—<br>++<br>++<br>++<br><br>0<br>×<br>×<br>×<br><br>×<br>×<br>×<br><br>×<br><br>×<br><br>× | —<br><br>×<br>—<br>×<br><br>— e<br>×<br>×<br>×<br><br>×<br>×<br>×<br><br>×<br>—<br>×<br><br>×<br>—<br>×<br><br>×<br><br>× | ×<br><br>×<br>×<br>×<br><br>+++++<br>×<br>+++++<br>×<br><br>—<br>—<br>×<br>—<br>+++++<br><br>—<br><br>×<br><br>×                                  | ×<br><br>×<br>×<br>×<br><br>×<br>—<br>—<br>×<br>—<br>×<br><br>×<br>×<br>×<br><br>×<br><br>×<br><br>× | ×<br><br>×<br>×<br>×<br><br>×<br>—<br>—<br>×<br>—<br>×<br><br>×<br><br>×<br><br>× |

Legend :—

- X..... Not examined.
- ..... No spermatozoa seen.
- O..... Abnormal spermatozoa present.
- OO..... Abnormal spermatozoa frequent.
- +..... Normal spermatozoa present.

Table 61 cont.

Results of Examination of the Genitalia of Nine Fowl Hens for the Distribution and Presence of Spermatozoa

|  |                           |   |   |  |                           |  |  |   |   |
|--|---------------------------|---|---|--|---------------------------|--|--|---|---|
| Four days.<br>29.<br>White Leghorn Pullet.<br>Not laying.<br>1.0 c.c.<br>Mixed from Cocks Nos. 6, 47 and 55.<br>Intraperitoneal with glass syringe, modified "Holborn" sheep<br>inseminator and trocar and canula. |                           |   |   | Six days.<br>60.<br>South African Black Australorp Hen.<br>Laid two fertile eggs: One chick from Cock No. 6<br>and one from Cock No. 61.<br>1.5 c.c.<br>Cocks Numbers 6 and 61.<br>Per vaginam with glass pipette. |                           |  |  |   |   |
| Ovary active.  |                           |   |   | Ovary active but some follicles show atretic changes.  |                           |  |  |   |   |
| 1  | With Capillary<br>action. | With Ringer's<br>solution and<br>glass pipette. | Dry film with<br>Giemsa's<br>stain (a). | Dry film with<br>Carbol-<br>Fuchsin (b).   | With Capillary<br>action. | Dry film with<br>Fuchsin and<br>Eosin (b). | Dry film with<br>Carbol acid<br>Fuchsin (c). | Dry film with<br>Giemsa's<br>stain (a). | V |
|  | 00                        | —   | —                                       | —  | ×                         | ×  | ×  | ×                                       |   |
|  | ×                         | ×   | ×                                       | ×  | ×                         | ×  | ×  | ×                                       |   |
|  | ×                         | ×   | ×                                       | ×  | ×                         | ×  | ×  | ×                                       |   |
|  | 00                        | 00  | ×                                       | ×  | ×                         | ×  | ×  | ×                                       |   |
|  | —                         | —   | —                                       | —  | ×                         | ×  | ×  | ×                                       |   |
|  | 00                        | 00  | ×                                       | ×  | C —                       | —  | —  | ×                                       |   |
|  | —                         | —   | —                                       | —  | —                         | 0?   | ×  | —                                       |   |
|  | —                         | —   | ×                                       | ×  | ×                         | —  | ×  | —                                       |   |
|  | —                         | —   | —                                       | —  | —                         | ×  | ×  | ×                                       |   |
|  | ×                         | ×   | ×                                       | ×  | ×                         | ×  | ×  | ×                                       |   |
|  | —                         | —   | —                                       | —  | —                         | —  | ×  | —                                       |   |
|  | ×                         | ×   | ×                                       | ×  | ×                         | ×  | ×  | ×                                       |   |
|  | —                         | ×   | —                                       | —  | —                         | —  | ×  | —                                       |   |
|  | ×                         | ×   | ×                                       | ×  | —                         | —  | ×  | —                                       |   |
|  | ×                         | ×   | ×                                       | ×  | ×                         | ×  | ×  | ×                                       |   |

++..... Normal spermatozoa frequent.  
 +++..... Motile spermatozoa seen.  
 ++++..... Vigorous progressively motile spermatozoa seen.  
 E..... Erythrocytes frequent.  
 L..... Lymphocytes present.  
 P..... Polymorphonuclear cells present.

Table 61 cont.

*natozoa of Different Times after Artificial Insemination using Various Techniques for Collection of Material.*

| Six days.   |                                   |                                      |                                      |                        |                               |                                      |                                      |
|---|-----------------------------------|--------------------------------------|--------------------------------------|------------------------|-------------------------------|--------------------------------------|--------------------------------------|
| 59.   |                                   |                                      |                                      |                        |                               |                                      |                                      |
| South African Black Australorp Hen.   |                                   |                                      |                                      |                        |                               |                                      |                                      |
| Laid four eggs, three were fertile and contained two Chicks from Cock No. 6, followed by one from Cock No. 61.                        |                                   |                                      |                                      |                        |                               |                                      |                                      |
| 1.2 c.c. Semen.   |                                   |                                      |                                      |                        |                               |                                      |                                      |
| Mixed semen from Cocks Numbers 6, 47 and 61; 0.4 c.c. each.   |                                   |                                      |                                      |                        |                               |                                      |                                      |
| Intraperitoneal with glass syringe, modified "Holborn" sheep inseminator and trocar and canula.                                       |                                   |                                      |                                      |                        |                               |                                      |                                      |
| Ovary active: Left oviduct slightly larger than right oviduct both fully developed, left fimbriae grasps smaller follicle than right. |                                   |                                      |                                      |                        |                               |                                      |                                      |
| Left Side.  |                                   |                                      |                                      | Right Side.            |                               |                                      |                                      |
| 1 With Capillary action.  | Dry film with Giemsa's stain (a). | Dry film with Fuchsin and Eosin (b). | Dry film with Fuchsin and Eosin (e). | With Capillary action. | Dry film with Giemsa's stain. | Dry film with Fuchsin and Eosin (b). | Dry film with Fuchsin and Eosin (e). |
| ×   | ×                                 | ×                                    | ×                                    | ×                      | ×                             | ×                                    | ×                                    |
| ×   | ×                                 | ×                                    | ×                                    | ×                      | ×                             | ×                                    | ×                                    |
| ×   | ×                                 | —                                    | —                                    | ×                      | ×                             | ×                                    | ×                                    |
| ×   | ×                                 | ×                                    | ×                                    | ×                      | ×                             | ×                                    | ×                                    |
| —   | ×                                 | —                                    | —                                    | —                      | ×                             | ×                                    | ×                                    |
| C—  | ×                                 | CE—                                  | ×                                    | C—                     | ×                             | CE—                                  | —                                    |
| —   | —                                 | ×                                    | ×                                    | —                      | —                             | ×                                    | —                                    |
| —   | ×                                 | ×                                    | ×                                    | —                      | ×                             | ×                                    | ×                                    |
| —   | ×                                 | ×                                    | ×                                    | —                      | ×                             | ×                                    | ×                                    |
| —   | —                                 | —                                    | ×                                    | —                      | ×                             | ×                                    | ×                                    |
| —   | ×                                 | ×                                    | ×                                    | —                      | ×                             | ×                                    | ×                                    |
| —   | ×                                 | ×                                    | ×                                    | —                      | ×                             | ×                                    | ×                                    |
| ×   | ×                                 | ×                                    | ×                                    | ×                      | ×                             | ×                                    | ×                                    |

B..... Bacteria present.  
M..... Mucus strands frequent.  
C..... Cilia and bundles of cilia resembling spermheads frequent.  
D..... Epithelial cells present.



Table 61 *cont.*

| Eight days.<br>24.<br>White Leghorn Pullet.<br>Laid four eggs, two were fertile from Cock No. 6.<br>1.0 c.c.<br>Mixed from Cocks Numbers 6, 38, 47 and 53.<br>Intraperitoneal with glass syringe and modified "Holborn" sheep inseminator with trocar and canula. |                                   |                                      |                                      | Eleven days.<br>46.<br>Buff Plymouth Rock Hen.<br>Laid five eggs, three were fertile.<br>1.0 c.c.<br>Mixed from Cocks Nos. 6, 47 and 35.<br>Intraperitoneal with glass syringe and long, coarse, sharp needle. |                                   |                                      |
|---|-----------------------------------|--------------------------------------|--------------------------------------|--|-----------------------------------|--------------------------------------|
| Ovary active: Many large follicles present.   |                                   |                                      |                                      | Ovary active: Many large follicles present.  |                                   |                                      |
| With Ringar's solution and glass pipette.   | Dry film with Giemsa's stain (a). | Dry film with Fuchsin and Eosin (b). | Dry film with Fuchsin and Eosin (e). | With Capillary action.   | Dry film with Giemsa's stain (a). | Dry film with Fuchsin and Eosin (b). |
| L —   | ×                                 | ×                                    | ×                                    | E —  | E —                               | E —                                  |
| ×   | ×                                 | ×                                    | ×                                    | ×  | —                                 | —                                    |
| EL —  | ×                                 | ×                                    | ×                                    | ×  | —                                 | —                                    |
| ×   | ×                                 | ×                                    | ×                                    | ×  | —                                 | —                                    |
| —   | ×                                 | ×                                    | ×                                    | E —  | E —                               | CE —                                 |
| COO?  | ×                                 | ×                                    | ×                                    | +++  | DC —                              | DC —                                 |
| COO?  | C —                               | C —                                  | ×                                    | ++++   | DOO                               | DOO                                  |
| COO?  | C —                               | ×                                    | D —                                  | ++++   | DOO                               | DCCO                                 |
| COO?  | ×                                 | ×                                    | —                                    | —  | —                                 | —                                    |
| ×   | ×                                 | —                                    | ×                                    | D —  | ×                                 | ×                                    |
| E —   | ×                                 | D —                                  | ×                                    | D —  | —                                 | —                                    |
| —   | ×                                 | ×                                    | ×                                    | —  | ×                                 | ×                                    |
| ×   | ×                                 | ×                                    | ×                                    | —  | —                                 | —                                    |
| —   | ×                                 | ×                                    | ×                                    | —  | ×                                 | ×                                    |
| —   | —                                 | ×                                    | ×                                    | C —  | —                                 | —                                    |
| —   | ×                                 | ×                                    | —                                    | C —  | ×                                 | ×                                    |
| ×   | ×                                 | ×                                    | ×                                    | ×  | ×                                 | ×                                    |

NOTE.—The slaughter of these birds took place over the period of about a year during which the method of collecting specimens with the help of capillary action of very thin glass tubes was evolved (see v. Drimmelen, 1945b). There was a marked difference between the time spent and the methods employed in the case of these nine P.M. investigations.

Table 61 cont

| Eleven days.<br>46.<br>Buff Plymouth Rock Hen.<br>Laid five eggs, three were fertile.<br>1.0 c.c.<br>Mixed from Cocks Nos. 6, 47 and 35.<br>Intraperitoneal with glass syringe and long,<br>coarse, sharp needle. |   |  | Fourteen days.<br>45.<br>Buff Plymouth Rock Hen.<br>Laid six eggs, four were fertile from Cock<br>No. 6.<br>1.0 c.c.<br>Mixed from Cocks Nos. 6, 47, 53<br>and 55.<br><i>Per vaginam</i> per glass pipette. |   |  | Interval.<br>No.<br>Age and Breed.<br>Production.<br>Amount.<br>Donor.<br>Metho.l. |
|---|---|--|---|---|--|--|
| Ovary active: Many large follicles present.   |   |  | Ovary active; shelled egg in uterus proved<br>to be fertile.  |   |  | Macroscopical.   |
| With Capillary<br>action.   | Dry film with<br>Giemsa's<br>stain (a). | Dry film with<br>Fuchsin and<br>Eosin (b). | With Capillary<br>action.   | Dry film with<br>Giemsa's<br>stain (a). | Dry film with<br>Fuchsin and<br>Eosin (b). | Microscopical<br>Method.   |
| E -   | E -                                     | E -  | -   | x                                       | x  | Intestines.  |
| x   | -                                       | -  | x   | -                                       | -  | } Ovary.   |
| x   | -                                       | -  | E -   | -                                       | -  |  |
| x   | -                                       | -  | 0?  | x                                       | x  |  |
| E -   | E -                                     | CE -                                       | CL -  | DC -                                    | C -  | } Infundibulum.  |
| +++   | DC -                                    | DC -                                       | +++   | 0?                                      | C -  |  |
| +++++   | DOO                                     | DOO  | CL -  | C -                                     | C -  |  |
| +++++   | DOO                                     | DCOO                                       | C -   | C -                                     | C -  |  |
| -   | -                                       | -  | -   | -                                       | -  | } Albumen region.  |
| D -   | x                                       | x  | C -   | -                                       | -  |  |
| D -   | -                                       | -  | -   | -                                       | x  | } Isthmus.   |
| -   | x                                       | x  | C -   | -                                       | -  |  |
| -   | -                                       | -  | C -   | -                                       | -  |  |
| -   | x                                       | x  | x   | x                                       | x  | Uterus.  |
| C -   | -                                       | -  | x   | -                                       | -  | Vagina.  |
| C -   | x                                       | x  | x   | -                                       | -  | Cloaca.  |
| x   | x                                       | x  | x   | x                                       | x  |  |

Summary of the Results Obtained in the Examination of the Genital Organs of Hens by Various Methods during the Fourth Series

| Methods of Insemination.  |                                | Nat.         | Nat. | Nat.   | Nat.                   | Nat.          | Vag. |  |
|---|--------------------------------|--------------|------|--------|------------------------|---------------|------|--|
| Number of Hen.....  |                                | 936          | 912  | 931    | 921                    | 940           |      |  |
| Amount of Semen.....  |                                | ?            | ?    | ?      | ?                      | 0.4 c.c.      |      |  |
| Donor of Semen; Cocks' Numbers.....   |                                | 64           | 63   | 63     | 64                     | 53 and 55     |      |  |
| Instruments applied in insemination.....  |                                | —            | —    | —      | —                      | Pip.          |      |  |
| Period of observation.....  | Before insemination.....       | 14           | 21   | 24     | 19                     | 12            |      |  |
|   | { No. of days.....             | 6            | 4    | 9      | 7                      | 3             |      |  |
|   | { No. of eggs laid.....        |              |      |        |                        |               |      |  |
|   | After insemination.....        | 1            | 4    | 9      | 14                     | $\frac{1}{8}$ |      |  |
|   | { No. of days.....             | 0            | 2    | 4      | 8                      | 1             |      |  |
|   | { No. of eggs laid.....        | 0            | 2    | 0      | 0                      | 0             |      |  |
|   | { No. of eggs proved fertile.. |              |      |        |                        | 0 (a)         |      |  |
| Locations where normal spermatozoa were found (i.e. actively motile in moist preparations or morphologically complete in fixed and stained preparations | Intestines.....                | ×            | ×    | ×      | ×                      | —             |      |  |
|   | Ovary.....                     | —            | —    | —      | —                      | —             |      |  |
|   | Infundibulum funnel.....       | C            | C    | ×      | ×                      | —             |      |  |
|   | Chalaziferous region. {        | Cranial..... | ×    | —      | ×                      | ×             | —    |  |
|   |                                | Middle.....  | ×    | ++ (c) | C                      | ×             | —    |  |
|   |                                | Caudal.....  | C    | C      | ×                      | ×             | —    |  |
|   | Albumen region.....            | —            | —    | ×      | —                      | —             |      |  |
|   | Isthmus.....                   | —            | —    | ×      | —                      | —             |      |  |
|   | Uterus.....                    | —            | —    | ×      | —                      | +++           |      |  |
|   | Vagina.....                    | C            | —    | C      | —                      | +++           |      |  |
|   | Cloaca.....                    | ×            | —    | ×      | ×                      | +++           |      |  |
| Locations where abnormal spermatozoa were found.....  | —                              | —            | —    | —      | —                      |               |      |  |
| State of oviduct <i>re</i> egg formation.....   | One Egg in Isthmus             | Empty        | ?    | ?      | Shelled Eggs in Uterus |               |      |  |

REMARKS.—(a) Number of eggs laid after insemination includes eggs taken from uterus.

(b) Number of eggs laid after insemination includes an egg from an ovum ovulated before insemination.

(c) Observation in fixed stained section of mucous membrane only.

NOTE.—The slaughter or operations on the cases tabulated here (64) took place during the first month of the breeding season (July) at the Onderstepoort Poultry Plant and all the subjects were pullets just commencing to lay (White Leghorn).

Nat.—Natural mating.

Vag.—Insemination *per Vaginan*.

Intr.—Intraperitoneal insemination.

Pip.—Glass pipette.





TABLE 64.

*s of Inseminations in a Comparison of the Effect of the Different Methods of Insemination on the Distribution of Sperm in the Organs.*

| Vag.                          | Vag.                                 | Vag.                          | Vag.                          | Intr.                               | Intr.                                 | Intr.                        | Intr.                               | Intr.                         | Intr.                        | Intr.                                   | Intr.                         | Intr.                               | Intr.                         |
|-------------------------------|--------------------------------------|-------------------------------|-------------------------------|-------------------------------------|---------------------------------------|------------------------------|-------------------------------------|-------------------------------|------------------------------|---|-------------------------------|-------------------------------------|-------------------------------|
| 907<br>0.2 c.c.<br>64<br>Pip. | 922<br>1.1 c.c.<br>47 and 53<br>Pip. | 904<br>0.4 c.c.<br>47<br>Pip. | 943<br>0.45 c.c.<br>6<br>CSS. | 925<br>1.0 c.c.<br>6 and 47<br>CSS. | 905<br>0.6 c.c.<br>53 and 47<br>Holb. | 902<br>0.5 c.c.<br>6<br>CSS. | 927<br>1.0 c.c.<br>6 and 61<br>CSS. | 911<br>0.8 c.c.<br>47<br>FB3. | 933<br>0.4 c.c.<br>6<br>CSS. | 915<br>0.6 c.c.<br>6, 61 and 62<br>FB3. | 901<br>0.4 c.c.<br>47<br>CSS. | 920<br>0.9 c.c.<br>6 and 47<br>CSS. | 941<br>0.3 c.c.<br>61<br>Pip. |
| —                             | 17<br>8                              | 21<br>3                       | 10<br>2                       | 15<br>5                             | 10<br>4                               | 21<br>8                      | 19<br>4                             | 19<br>4                       | 8<br>4                       | 17<br>4                                 | 8<br>5                        | 9<br>4                              | 8<br>3                        |
| 1                             | 4                                    | 12                            | 1                             | 2                                   | 4                                     | 3                            | 12                                  | 12                            | 16                           | 16                                      | 20                            | 27                                  | 28                            |
| 1                             | 3                                    | 8                             | 1                             | 0                                   | 1                                     | 4                            | 9                                   | 4                             | 10                           | 9                                       | 5                             | 15                                  | 13                            |
| 0 (b)                         | 3 (a)                                | 1 (a)                         | 0 (b)                         | 0                                   | 0 (b)                                 | 3 (a)                        | 6 (a)                               | 1 (a)                         | 4                            | 6                                       | 0 (a)                         | 2                                   | 1                             |
| —                             | ×                                    | ×                             | —                             | —                                   | —                                     | ×                            | ×                                   | ×                             | ×                            | —                                       | ×                             | ×                                   | ×                             |
| —                             | ×                                    | ×                             | +                             | —                                   | —                                     | +                            | —                                   | —                             | —                            | —                                       | —                             | —                                   | —                             |
| —                             | ×                                    | ×                             | +                             | —                                   | —                                     | +                            | —                                   | —                             | —                            | —                                       | —                             | —                                   | —                             |
| —                             | ×                                    | ×                             | +                             | —                                   | —                                     | +                            | —                                   | —                             | —                            | —                                       | —                             | —                                   | —                             |
| ×                             | —                                    | —                             | +                             | —                                   | ×                                     | +                            | +                                   | +                             | +                            | +                                       | +                             | +                                   | +                             |
| —                             | —                                    | —                             | ×                             | ×                                   | —                                     | —                            | ×                                   | ×                             | ×                            | ×                                       | ×                             | ×                                   | ×                             |
| —                             | —                                    | —                             | ×                             | ×                                   | —                                     | —                            | ×                                   | ×                             | ×                            | ×                                       | ×                             | ×                                   | ×                             |
| +                             | —                                    | —                             | ×                             | ×                                   | —                                     | +                            | —                                   | —                             | —                            | —                                       | —                             | —                                   | —                             |
| +                             | ×                                    | —                             | ×                             | ×                                   | —                                     | ×                            | +                                   | +                             | +                            | +                                       | +                             | +                                   | +                             |
| +                             | ×                                    | ×                             | ×                             | ×                                   | ×                                     | —                            | ×                                   | —                             | —                            | ×                                       | ×                             | ×                                   | ×                             |
| Uterus                        | —                                    | —                             | —                             | —                                   | Infundibulum                          | —                            | Uterus and Vagina                   | —                             | —                            | —                                       | —                             | —                                   | —                             |
| Egg in Isthmus                | Shelled Egg in Uterus                | Shelled Egg in Uterus         | ?                             | Membranous Egg in uterus            | Ovum in Albumen region                | Shelled Egg in Uterus        | Membranous Egg in Uterus            | Shelled Egg in Uterus         | Empty                        | Empty                                   | Membranous Egg in Uterus      | ?                                   | ?                             |

Syr.—All-glass syringe.  
 C.S.S.—Coarse, sharp needle with single aperture.  
 F.B. 3.—Fine, blunt needle with three apertures.  
 Holb.—Modified "Holborn" sheep insemination pipette.

Legend:—  
 X..... Not examined.  
 +..... No spermatozoa seen.  
 ..... Normal spermatozoa present.  
 ..... Normal spermatozoa frequent.  
 ..... Motile spermatozoa seen.  
 ..... Vigorous progressively motile spermatozoa seen.  
 C..... Cilia and bundles of cilia resembling spermheads frequent.  
 N..... Observations not confirmed by stained films examined.