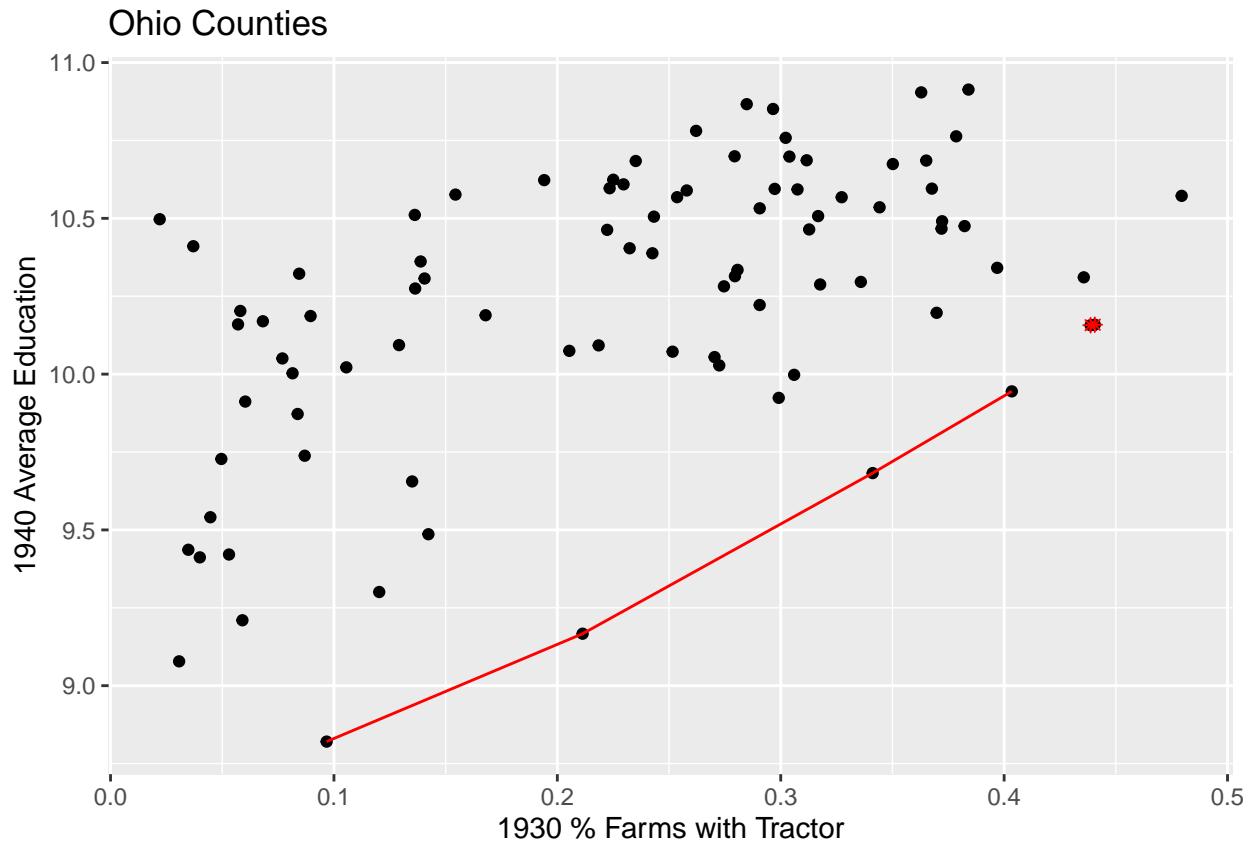# Ohio

Analysis of Ohio Education and Tractor Data

```
## Parsed with column specification:
## cols(
##   X1 = col_double(),
##   X = col_double(),
##   year = col_double(),
##   state = col_double(),
##   county = col_double(),
##   name = col_character(),
##   percent_farm_tractor = col_double(),
##   stateAbb = col_character(),
##   fips = col_double(),
##   colorID = col_double()
## )
## Parsed with column specification:
## cols(
##   X1 = col_double(),
##   X = col_double(),
##   year = col_double(),
##   state = col_double(),
##   county = col_double(),
##   name = col_character(),
##   percent_farm_tractor = col_double(),
##   stateAbb = col_character(),
##   fips = col_double(),
##   colorID = col_double()
## )
```

Exploratory Plots of Average Education by County Vs. % of Farms with Tractors
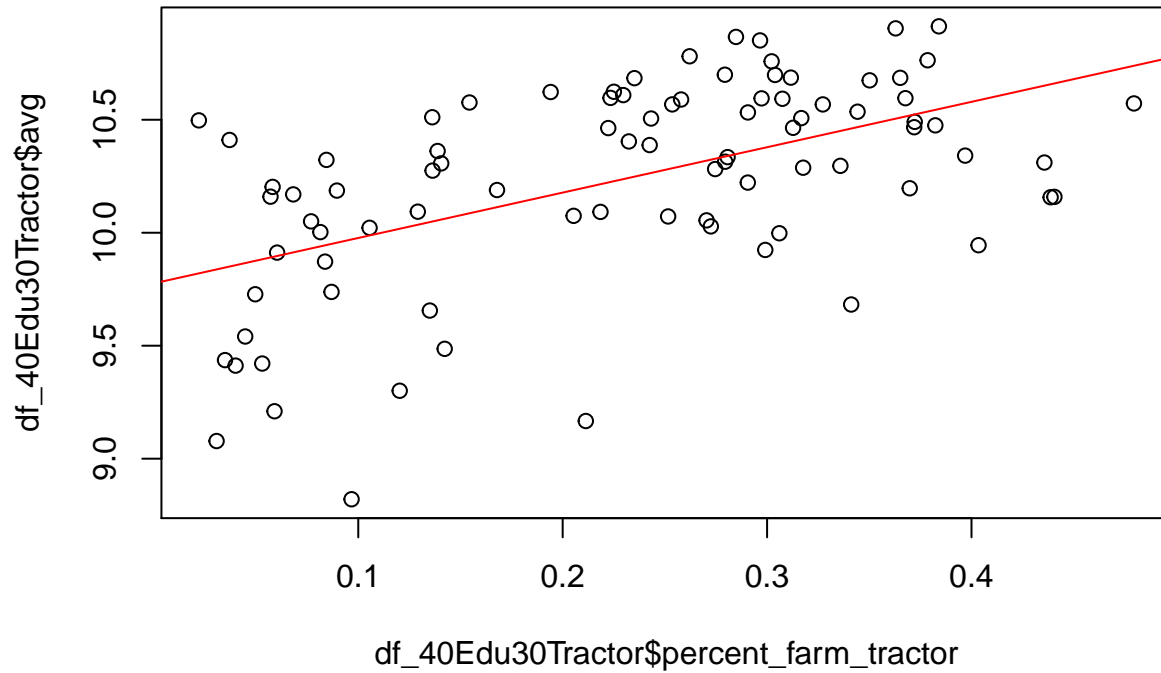
Ohio 1940 Average Education Vs. Ohio 1930 % of Farms with Tractor

Linear Model 1940 Avg. Edu vs 1930 % Farm w/ Tractor

```r
ohEduModLinear <- lm(avg ~ percent_farm_tractor, data = df_40Edu30Tractor)
plot(df_40Edu30Tractor$percent_farm_tractor, df_40Edu30Tractor$avg, main = "Linear")
abline(ohEduModLinear, col = "red")
```
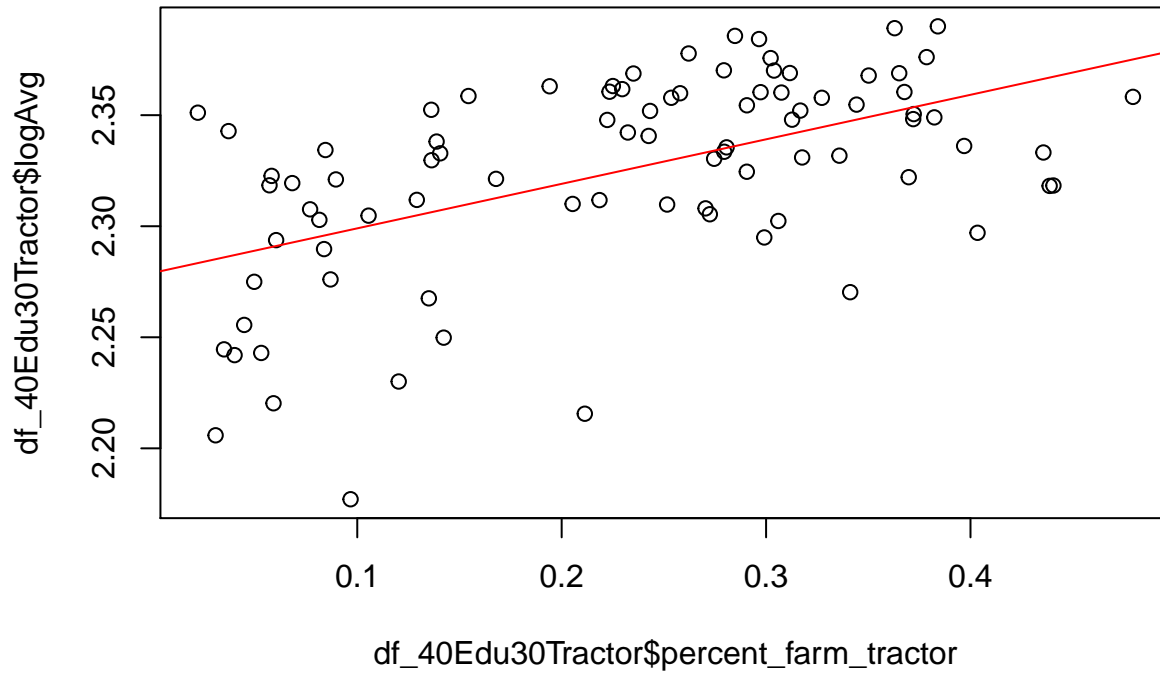
Linear


```
summary(ohEduModLinear)
```

```
##
## Call:
## lm(formula = avg ~ percent_farm_tractor, data = df_40Edu30Tractor)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.14966 -0.22211  0.06822  0.28365  0.67705
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)            9.7760     0.0882 110.833  < 2e-16 ***
## percent_farm_tractor   2.0083     0.3401   5.906 7.03e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.383 on 85 degrees of freedom
## Multiple R-squared:  0.2909, Adjusted R-squared:  0.2826
## F-statistic: 34.88 on 1 and 85 DF,  p-value: 7.025e-08
```

Log-Linear Model 1940 Avg. Edu vs 1930 % Farm w/ Tractor

```
df_40Edu30Tractor$logAvg <- log(df_40Edu30Tractor$avg)
ohEduModLogLinear <- lm(logAvg ~ percent_farm_tractor, data = df_40Edu30Tractor)
plot(df_40Edu30Tractor$percent_farm_tractor, df_40Edu30Tractor$logAvg, main = "Log-Linear")
abline(ohEduModLogLinear, col = "red")
```

Log–Linear


```r
summary(ohEduModLogLinear)
```

```
##
## Call:
## lm(formula = logAvg ~ percent_farm_tractor, data = df_40Edu30Tractor)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.121302 -0.021393  0.007532  0.027990  0.067698
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)          2.279001   0.008841  257.76  < 2e-16 ***
## percent_farm_tractor 0.200427   0.034087    5.88 7.85e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03839 on 85 degrees of freedom
## Multiple R-squared:  0.2891, Adjusted R-squared:  0.2808
## F-statistic: 34.57 on 1 and 85 DF,  p-value: 7.848e-08
```

Linear-Log Model 1940 Avg. Edu vs 1930 % Farm w/ Tractor

```r
df_40Edu30Tractor$logPercent <- log(df_40Edu30Tractor$percent_farm_tractor)
ohEduModLinearLog <- lm(avg ~ logPercent, data = df_40Edu30Tractor)
plot(df_40Edu30Tractor$logPercent, df_40Edu30Tractor$avg, main = "Linear-Log")
abline(ohEduModLinearLog, col = "red")
```
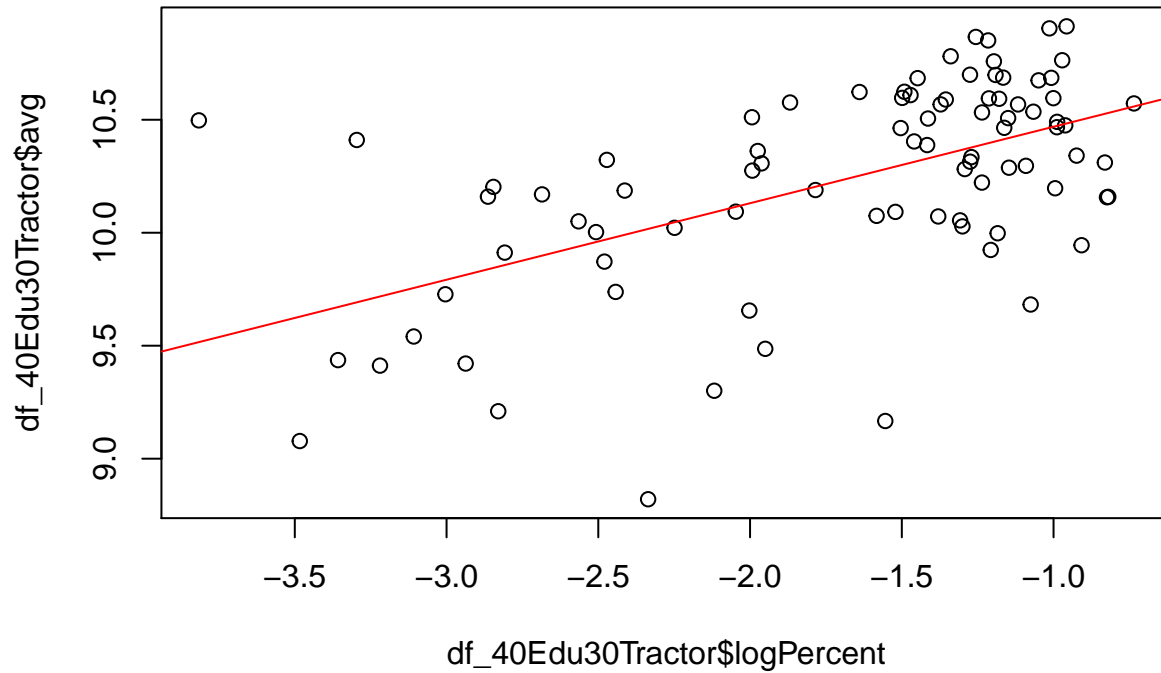
Linear–Log


```r
summary(ohEduModLinearLog)
```

```
## 
## Call:
## lm(formula = avg ~ logPercent, data = df_40Edu30Tractor)
## 
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.19632 -0.21516  0.05499  0.27234  0.98138
## 
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 10.80745    0.09983 108.255  < 2e-16 ***
## logPercent   0.33845    0.05417   6.248 1.59e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 0.3766 on 85 degrees of freedom
## Multiple R-squared:  0.3147, Adjusted R-squared:  0.3067
## F-statistic: 39.04 on 1 and 85 DF,  p-value: 1.589e-08
```

Linear Model VAM 1947 vs Percent 1930

```r
vam47Tractor30Mod <- lm(VAM ~ percent_farm_tractor, data = vam1947Tractor30)
plot(vam1947Tractor30$percent_farm_tractor, vam1947Tractor30$VAM, main = "Linear")
abline(vam47Tractor30Mod, col = "red")
```

Linear


```r
summary(vam47Tractor30Mod)
```

```
##
## Call:
## lm(formula = VAM ~ percent_farm_tractor, data = vam1947Tractor30)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -462.10 -208.32  -45.39  235.30  556.35
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)            208.46      62.12   3.356 0.001226 **
## percent_farm_tractor   873.07     241.54   3.615 0.000531 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 267.9 on 78 degrees of freedom
## Multiple R-squared:  0.1435, Adjusted R-squared:  0.1325
## F-statistic: 13.07 on 1 and 78 DF,  p-value: 0.000531
```

Residuals from VAM 47 vs. Percent 30

```r
vam47Residuals <-data.frame(vam47Tractor30Mod$residuals, vam1947Tractor30$county, vam1947Tractor30)
vam47Residuals
```

```
##   vam47Tractor30Mod.residuals vam1947Tractor30.county  fips county        avg
## 1                 -214.994273                      10 39001     10   9.209961
## 2                  428.070892                      30 39003     30  10.623929
```

```
## 3                      472.063509        50 39005     50 10.622720
## 4                       84.058441        70 39007     70 10.609148
## 5                     -169.993062        90 39009     90 10.169675
## 6                       61.007663       110 39011    110 10.507224
## 7                      -58.614924       130 39013    130 10.050313
## 8                     -206.340345       150 39015    150  9.738122
## 9                      401.695552       170 39017    170 10.196781
## 10                      -8.633830       190 39019    190 10.186483
## 11                    -125.520252       210 39021    210 10.054731
## 13                    -265.328863       250 39025    250  9.655556
## 14                    -316.779148       270 39027    270 10.287815
## 15                     266.818266       290 39029    290 10.306936
## 16                     435.831153       310 39031    310 10.322308
## 17                     384.628013       330 39033    330 10.851064
## 19                    -328.143794       370 39037    370 10.221900
## 20                     -55.972853       390 39039    390 10.341207
## 21                    -148.513357       410 39041    410 10.596730
## 22                     306.763656       430 39043    430 10.685484
## 23                      82.250417       450 39045    450 10.074779
## 24                    -395.688823       470 39047    470  9.944751
## 25                      79.681637       490 39049    490 10.758445
## 26                    -157.187923       510 39051    510 10.567867
## 27                    -214.256282       530 39053    530  9.078111
## 28                    -138.113593       550 39055    550 10.072043
## 29                    -327.773284       570 39057    570 10.698218
## 30                     -36.279397       590 39059    590 10.159635
## 32                     -58.745962       630 39063    630 10.913314
## 33                    -293.189494       650 39065    650 10.281763
## 34                     -99.582105       670 39067    670  9.872080
## 35                    -462.100049       690 39069    690 10.158685
## 36                    -139.027462       710 39071    710 10.189036
## 37                      41.890732       730 39073    730  9.911968
## 38                    -241.680920       750 39075    750  9.486194
## 39                    -155.190608       770 39077    770 10.674342
## 40                      76.527608       790 39079    790  9.540707
## 41                     234.802219       810 39081    810 10.093175
## 42                     325.634939       830 39083    830 10.511027
## 43                     280.482618       850 39085    850 10.686385
## 44                     368.636885       870 39087    870  9.411918
## 45                     117.350774       890 39089    890 10.361612
## 46                    -274.716377       910 39091    910 10.684086
## 47                     349.053411       930 39093    930 10.763259
## 48                     518.069785       950 39095    950 10.592837
## 49                    -370.307338       970 39097    970  9.682366
## 50                     522.121661       990 39099    990 10.567978
## 51                     203.560118      1010 39101   1010 10.490716
## 52                       8.646107      1030 39103   1030 10.699282
## 53                    -201.757571      1050 39105   1050  9.727691
## 54                     -93.612800      1070 39107   1070  9.997748
## 55                     246.516899      1090 39109   1090 10.464348
## 56                    -238.855979      1110 39111   1110  9.436264
## 58                    -187.791582      1150 39115   1150 10.410557
## 59                    -343.259852      1170 39117   1170 10.576296
## 60                     320.415170      1190 39119   1190 10.002766
```

```
## 61                    -178.672979                  1210 39121    1210 10.497222
## 62                     -62.817490                  1230 39123    1230 10.310724
## 63                    -456.480284                  1250 39125    1250 10.157001
## 64                     -45.595543                  1270 39127    1270 10.021769
## 65                    -283.910975                  1310 39131    1310  8.820574
## 66                      76.702578                  1330 39133    1330 10.780847
## 67                    -442.686375                  1350 39135    1350 10.296046
## 68                    -381.604269                  1370 39137    1370  9.923810
## 70                     -91.948146                  1410 39141    1410  9.166793
## 71                     241.547837                  1430 39143    1430 10.595465
## 72                     169.538758                  1450 39145    1450  9.300681
## 73                     397.767524                  1470 39147    1470 10.475133
## 74                     236.782384                  1490 39149    1490 10.466939
## 75                     556.350539                  1510 39151    1510 10.589506
## 78                     259.489252                  1570 39157    1570 10.274903
## 79                    -215.824224                  1590 39159    1590 10.505435
## 80                    -126.027018                  1610 39161    1610 10.594572
## 81                      -3.748685                  1630 39163    1630  9.421053
## 82                      83.648255                  1650 39165    1650 10.028030
## 83                      77.822668                  1670 39167    1670 10.202782
## 84                     139.775195                  1690 39169    1690 10.387983
## 85                     -45.180167                  1710 39171    1710 10.532258
## 86                     103.929477                  1730 39173    1730 10.572193
## 87                    -297.484334                  1750 39175    1750 10.314286
##    year.x state.x      name percent_farm_tractor stateAbb colorID.x   logAvg
## 1    1930      39     ADAMS           0.05903146       OH         1 2.220286
## 2    1930      39     ALLEN           0.22503726       OH         4 2.363109
## 3    1930      39   ASHLAND           0.19412039       OH         3 2.362995
## 4    1930      39  ASHTABULA           0.22963305       OH         4 2.361717
## 5    1930      39    ATHENS           0.06819313       OH         2 2.319410
## 6    1930      39  AUGLAIZE           0.31674026       OH         5 2.352063
## 7    1930      39   BELMONT           0.07692308       OH         2 2.307604
## 8    1930      39     BROWN           0.08691702       OH         2 2.276048
## 9    1930      39    BUTLER           0.36978534       OH         6 2.322072
## 10   1930      39   CARROLL           0.08954394       OH         2 2.321062
## 11   1930      39  CHAMPAIGN           0.27038425       OH         4 2.308043
## 13   1930      39  CLERMONT           0.13500993       OH         2 2.267533
## 14   1930      39   CLINTON           0.31764146       OH         5 2.330960
## 15   1930      39 COLUMBIANA           0.14056832       OH         3 2.332817
## 16   1930      39  COSHOCTON           0.08442982       OH         2 2.334307
## 17   1930      39   CRAWFORD           0.29655823       OH         5 2.384263
## 19   1930      39     DARKE           0.29056995       OH         5 2.324533
## 20   1930      39   DEFIANCE           0.39689471       OH         6 2.336137
## 21   1930      39   DELAWARE           0.22341568       OH         4 2.360545
## 22   1930      39      ERIE           0.36512580       OH         6 2.368886
## 23   1930      39  FAIRFIELD           0.20536013       OH         4 2.310035
## 24   1930      39    FAYETTE           0.40344168       OH         6 2.297045
## 25   1930      39   FRANKLIN           0.30222372       OH         5 2.375691
## 26   1930      39    FULTON           0.32727273       OH         5 2.357818
## 27   1930      39    GALLIA           0.03069700       OH         1 2.205866
## 28   1930      39    GEAUGA           0.25159236       OH         4 2.309764
## 29   1930      39    GREENE           0.30389016       OH         5 2.370077
## 30   1930      39  GUERNSEY           0.05706727       OH         1 2.318423
## 32   1930      39   HANCOCK           0.38403563       OH         6 2.389984
```

```
## 33    1930    39     HARDIN       0.27458694    OH       5 2.330372
## 34    1930    39    HARRISON      0.08375778    OH       2 2.289711
## 35    1930    39      HENRY        0.44056493    OH       7 2.318329
## 36    1930    39    HIGHLAND      0.16788079    OH       3 2.321312
## 37    1930    39    HOCKING       0.06030856    OH       1 2.293743
## 38    1930    39     HOLMES       0.14228546    OH       3 2.249838
## 39    1930    39      HURON       0.35018345    OH       6 2.367843
## 40    1930    39     JACKSON      0.04468912    OH       1 2.255568
## 41    1930    39    JEFFERSON     0.12913288    OH       2 2.311859
## 42    1930    39      KNOX        0.13619677    OH       2 2.352425
## 43    1930    39      LAKE        0.31161473    OH       5 2.368970
## 44    1930    39    LAWRENCE      0.03998243    OH       1 2.241977
## 45    1930    39     LICKING      0.13881301    OH       3 2.338108
## 46    1930    39      LOGAN       0.23510204    OH       4 2.368755
## 47    1930    39     LORAIN       0.37853851    OH       6 2.376138
## 48    1930    39      LUCAS       0.30750605    OH       5 2.360178
## 49    1930    39     MADISON      0.34115409    OH       6 2.270306
## 50    1930    39    MAHONING      0.25361367    OH       4 2.357828
## 51    1930    39     MARION       0.37223123    OH       6 2.350491
## 52    1930    39     MEDINA       0.27935677    OH       5 2.370177
## 53    1930    39      MEIGS       0.04959729    OH       1 2.274977
## 54    1930    39     MERCER       0.30599711    OH       5 2.302360
## 55    1930    39      MIAMI       0.31272085    OH       5 2.347974
## 56    1930    39     MONROE       0.03482003    OH       1 2.244560
## 58    1930    39     MORGAN       0.03703704    OH       1 2.342820
## 59    1930    39     MORROW       0.15440238    OH       3 2.358615
## 60    1930    39    MUSKINGUM     0.08147014    OH       2 2.302862
## 61    1930    39      NOBLE       0.02201122    OH       1 2.351111
## 62    1930    39     OTTAWA       0.43565976    OH       7 2.333185
## 63    1930    39    PAULDING      0.43870968    OH       7 2.318163
## 64    1930    39      PERRY       0.10553544    OH       2 2.304760
## 65    1930    39      PIKE        0.09673367    OH       2 2.177087
## 66    1930    39     PORTAGE      0.26211135    OH       4 2.377771
## 67    1930    39     PREBLE       0.33586132    OH       5 2.331760
## 68    1930    39     PUTNAM       0.29911504    OH       5 2.294937
## 70    1930    39      ROSS        0.21131448    OH       4 2.215588
## 71    1930    39    SANDUSKY      0.36766376    OH       6 2.360426
## 72    1930    39     SCIOTO       0.12027158    OH       2 2.230088
## 73    1930    39     SENECA       0.38230211    OH       6 2.349004
## 74    1930    39     SHELBY       0.37197665    OH       6 2.348222
## 75    1930    39      STARK       0.25793304    OH       4 2.359863
## 78    1930    39   TUSCARAWAS     0.13636364    OH       3 2.329704
## 79    1930    39      UNION       0.24324324    OH       4 2.351893
## 80    1930    39    VAN WERT      0.29730849    OH       5 2.360342
## 81    1930    39     VINTON       0.05302326    OH       1 2.242947
## 82    1930    39     WARREN       0.27248201    OH       5 2.305384
## 83    1930    39   WASHINGTON     0.05809575    OH       1 2.322660
## 84    1930    39      WAYNE       0.24255668    OH       4 2.340650
## 85    1930    39    WILLIAMS      0.29061161    OH       5 2.354443
## 86    1930    39      WOOD        0.47947411    OH       8 2.358227
## 87    1930    39     WYANDOT      0.27950617    OH       5 2.333530
##    logPercent   X.1     X      polyname RUCC        County VAM year.y
## 1  -2.8296848 10023 10023   ohio,adams    9    Adams County  45    1947
## 2  -1.4914893 10028 10028   ohio,allen    3    Allen County 833    1947
```
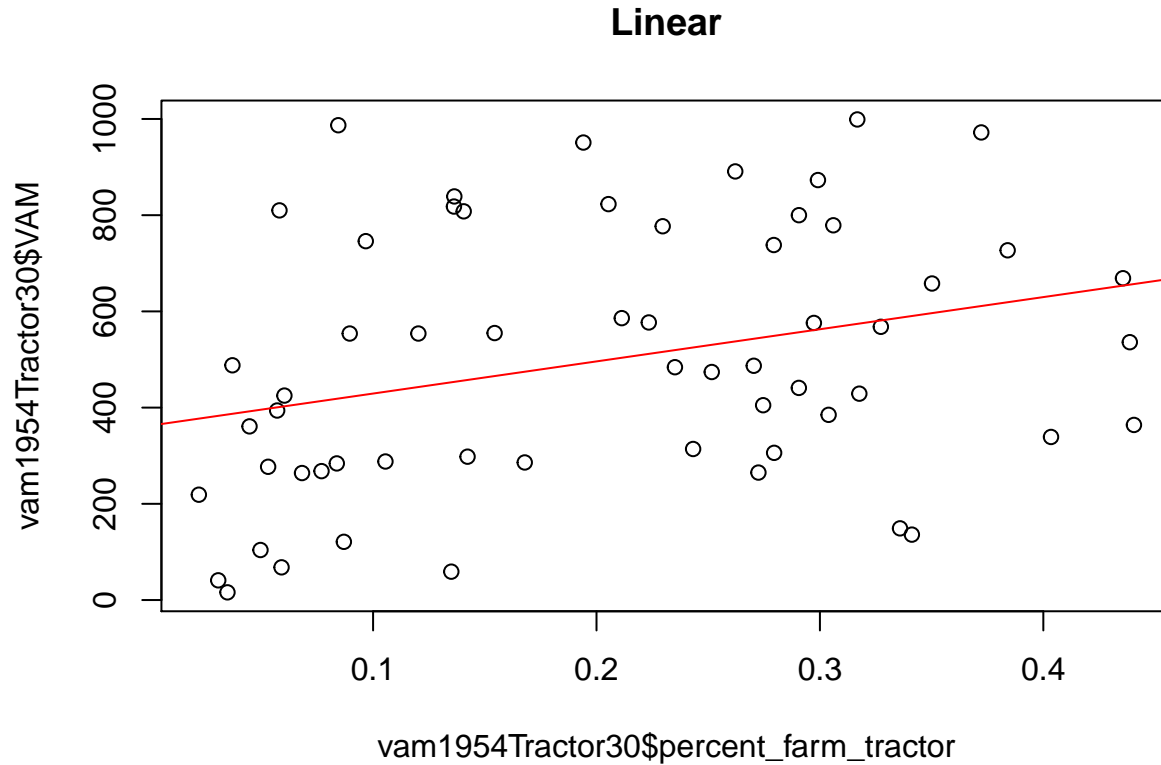
```
## 3  -1.6392767 10033 10033    ohio,ashland    6    Ashland County 850    1947
## 4  -1.4712727 10038 10038   ohio,ashtabula   4  Ashtabula County 493    1947
## 5  -2.6854114 10043 10043     ohio,athens    7     Athens County  98    1947
## 6  -1.1496732 10047 10047    ohio,auglaize   6   Auglaize County 546    1947
## 7  -2.5649494 10052 10052    ohio,belmont    2    Belmont County 217    1947
## 8  -2.4428014 10057 10057     ohio,brown     9      Brown County  78    1947
## 9  -0.9948326 10059 10059     ohio,butler    3     Butler County 933    1947
## 10 -2.4130259 10067 10067    ohio,carroll    6    Carroll County 278    1947
## 11 -1.3079112 10073 10073   ohio,champaign   6  Champaign County 319    1947
## 13 -2.0024070 10079 10079    ohio,clermont   8   Clermont County  61    1947
## 14 -1.1468320 10088 10088    ohio,clinton    6    Clinton County 169    1947
## 15 -1.9620617 10092 10092  ohio,columbiana   4 Columbiana County 598    1947
## 16 -2.4718346 10098 10098   ohio,coshocton   7  Coshocton County 718    1947
## 17 -1.2155117 10102 10102    ohio,crawford   7   Crawford County 852    1947
## 19 -1.2359109 10112 10112     ohio,darke     6      Darke County 134    1947
## 20 -0.9240842 10116 10116    ohio,defiance   7   Defiance County 499    1947
## 21 -1.4987212 10121 10121    ohio,delaware   6   Delaware County 255    1947
## 22 -1.0075133 10125 10125      ohio,erie     4       Erie County 834    1947
## 23 -1.5829901 10133 10133   ohio,fairfield   4  Fairfield County 470    1947
## 24 -0.9077233 10136 10136    ohio,fayette    6    Fayette County 165    1947
## 25 -1.1965877 10143 10143   ohio,franklin    2   Franklin County 552    1947
## 26 -1.1169614 10147 10147     ohio,fulton    6     Fulton County 337    1947
## 27 -3.4835903 10151 10151     ohio,gallia    6     Gallia County  21    1947
## 28 -1.3799451 10158 10158     ohio,geauga    4     Geauga County 290    1947
## 29 -1.1910890 10162 10162     ohio,greene    2     Greene County 146    1947
## 30 -2.8635245 10167 10167    ohio,guernsey   6   Guernsey County 222    1947
## 32 -0.9570199 10174 10174    ohio,hancock    4    Hancock County 485    1947
## 33 -1.2924873 10183 10183     ohio,hardin    6     Hardin County 155    1947
## 34 -2.4798262 10185 10185    ohio,harrison   6   Harrison County 182    1947
## 35 -0.8196974 10193 10193     ohio,henry     6      Henry County 131    1947
## 36 -1.7845011 10196 10196    ohio,highland   7   Highland County 216    1947
## 37 -2.8082813 10202 10202    ohio,hocking    7    Hocking County 303    1947
## 38 -1.9499200 10207 10207     ohio,holmes    6     Holmes County  91    1947
## 39 -1.0492981 10213 10213     ohio,huron     6      Huron County 359    1947
## 40 -3.1080252 10217 10217    ohio,jackson    6    Jackson County 324    1947
## 41 -2.0469134 10223 10223   ohio,jefferson   2  Jefferson County 556    1947
## 42 -1.9936546 10228 10228      ohio,knox     7       Knox County 653    1947
## 43 -1.1659877 10233 10233      ohio,lake     1       Lake County 761    1947
## 44 -3.2193153 10238 10238    ohio,lawrence   3   Lawrence County 612    1947
## 45 -1.9746275 10243 10243    ohio,licking    4    Licking County 447    1947
## 46 -1.4477356 10248 10248     ohio,logan     7      Logan County 139    1947
## 47 -0.9714375 10250 10250     ohio,lorain    3     Lorain County 888    1947
## 48 -1.1792605 10258 10258     ohio,lucas     2      Lucas County 995    1947
## 49 -1.0754210 10259 10259    ohio,madison    6    Madison County 136    1947
## 50 -1.3719432 10268 10268    ohio,mahoning   2   Mahoning County 952    1947
## 51 -0.9882400 10273 10273     ohio,marion    5     Marion County 737    1947
## 52 -1.2752656 10278 10278     ohio,medina    6     Medina County 461    1947
## 53 -3.0038191 10280 10280      ohio,meigs    7      Meigs County  50    1947
## 54 -1.1841796 10288 10288     ohio,mercer    7     Mercer County 382    1947
## 55 -1.1624443 10291 10291      ohio,miami    6      Miami County 728    1947
## 56 -3.3575624 10297 10297     ohio,monroe    8     Monroe County   0    1947
## 58 -3.2958369 10305 10305     ohio,morgan    9     Morgan County  53    1947
## 59 -1.8681932 10309 10309     ohio,morrow    9     Morrow County   0    1947
## 60 -2.5075187 10314 10314   ohio,muskingum   5  Muskingum County 600    1947
```

```
## 61 -3.8162029 10320 10320       ohio,noble    8       Noble County  49   1947
## 62 -0.8308937 10324 10324       ohio,ottawa   6      Ottawa County 526   1947
## 63 -0.8239174 10329 10329     ohio,paulding   9    Paulding County 135   1947
## 64 -2.2487085 10336 10336        ohio,perry   7       Perry County 255   1947
## 65 -2.3357938 10347 10347         ohio,pike   9        Pike County   9   1947
## 66 -1.3389859 10353 10353      ohio,portage   6     Portage County 514   1947
## 67 -1.0910569 10357 10357       ohio,preble   6      Preble County  59   1947
## 68 -1.2069270 10362 10362       ohio,putnam   6      Putnam County  88   1947
## 70 -1.5544078 10371 10371         ohio,ross   5        Ross County 301   1947
## 71 -1.0005864 10374 10374     ohio,sandusky   7    Sandusky County 771   1947
## 72 -2.1180029 10381 10381       ohio,scioto   4      Scioto County 483   1947
## 73 -0.9615441 10386 10386       ohio,seneca   7      Seneca County 940   1947
## 74 -0.9889242 10391 10391       ohio,shelby   7      Shelby County 770   1947
## 75 -1.3550553 10397 10397        ohio,stark   2       Stark County 990   1947
## 78 -1.9924302 10412 10412 ohio,tuscarawas   6 Tuscarawas County 587   1947
## 79 -1.4136933 10417 10417        ohio,union   6       Union County 205   1947
## 80 -1.2129850 10423 10423     ohio,van wert   6    Van Wert County 342   1947
## 81 -2.9370247 10428 10428       ohio,vinton   9      Vinton County 251   1947
## 82 -1.3001827 10432 10432       ohio,warren   6      Warren County 530   1947
## 83 -2.8456628 10438 10438   ohio,washington   7 Washington County 337   1947
## 84 -1.4165199 10443 10443        ohio,wayne   6       Wayne County 560   1947
## 85 -1.2357676 10448 10448     ohio,williams   7    Williams County 417   1947
## 86 -0.7350654 10451 10451         ohio,wood   6        Wood County 731   1947
## 87 -1.2747309 10457 10457      ohio,wyandot   7     Wyandot County 155   1947
##     state.y state.low      county.low colorID.y   color
## 1      Ohio      ohio      adams county         1 #FF0000
## 2      Ohio      ohio      allen county        13 #3F0CF9
## 3      Ohio      ohio    ashland county        13 #3F0CF9
## 4      Ohio      ohio  ashtabula county         8 #A61DE0
## 5      Ohio      ohio     athens county         2 #F20420
## 6      Ohio      ohio   auglaize county         9 #951DF1
## 7      Ohio      ohio    belmont county         4 #D90C60
## 8      Ohio      ohio      brown county         2 #F20420
## 9      Ohio      ohio     butler county        14 #2A08FB
## 10     Ohio      ohio    carroll county         5 #CC1180
## 11     Ohio      ohio  champaign county         5 #CC1180
## 13     Ohio      ohio   clermont county         1 #FF0000
## 14     Ohio      ohio    clinton county         3 #E50840
## 15     Ohio      ohio columbiana county         9 #951DF1
## 16     Ohio      ohio  coshocton county        11 #6A15F5
## 17     Ohio      ohio   crawford county        13 #3F0CF9
## 19     Ohio      ohio      darke county         2 #F20420
## 20     Ohio      ohio   defiance county         8 #A61DE0
## 21     Ohio      ohio   delaware county         4 #D90C60
## 22     Ohio      ohio       erie county        13 #3F0CF9
## 23     Ohio      ohio  fairfield county         7 #B319C0
## 24     Ohio      ohio    fayette county         3 #E50840
## 25     Ohio      ohio   franklin county         9 #951DF1
## 26     Ohio      ohio     fulton county         5 #CC1180
## 27     Ohio      ohio     gallia county         1 #FF0000
## 28     Ohio      ohio     geauga county         5 #CC1180
## 29     Ohio      ohio     greene county         3 #E50840
## 30     Ohio      ohio   guernsey county         4 #D90C60
## 32     Ohio      ohio    hancock county         8 #A61DE0
```

```
## 33    Ohio    ohio     hardin county      3 #E50840
## 34    Ohio    ohio    harrison county      3 #E50840
## 35    Ohio    ohio      henry county       2 #F20420
## 36    Ohio    ohio    highland county      4 #D90C60
## 37    Ohio    ohio     hocking county      5 #CC1180
## 38    Ohio    ohio      holmes county      2 #F20420
## 39    Ohio    ohio      huron county       6 #BF15A0
## 40    Ohio    ohio     jackson county      5 #CC1180
## 41    Ohio    ohio   jefferson county      9 #951DF1
## 42    Ohio    ohio       knox county      10 #8019F3
## 43    Ohio    ohio       lake county      12 #5511F7
## 44    Ohio    ohio    lawrence county      9 #951DF1
## 45    Ohio    ohio     licking county      7 #B319C0
## 46    Ohio    ohio      logan county       3 #E50840
## 47    Ohio    ohio     lorain county      14 #2A08FB
## 48    Ohio    ohio      lucas county      15 #1504FD
## 49    Ohio    ohio     madison county      2 #F20420
## 50    Ohio    ohio    mahoning county     14 #2A08FB
## 51    Ohio    ohio     marion county      11 #6A15F5
## 52    Ohio    ohio     medina county       7 #B319C0
## 53    Ohio    ohio      meigs county       1 #FF0000
## 54    Ohio    ohio     mercer county       6 #BF15A0
## 55    Ohio    ohio      miami county      11 #6A15F5
## 56    Ohio    ohio     monroe county       1 #FF0000
## 58    Ohio    ohio     morgan county       1 #FF0000
## 59    Ohio    ohio     morrow county       1 #FF0000
## 60    Ohio    ohio   muskingum county      9 #951DF1
## 61    Ohio    ohio      noble county       1 #FF0000
## 62    Ohio    ohio     ottawa county       8 #A61DE0
## 63    Ohio    ohio    paulding county      2 #F20420
## 64    Ohio    ohio      perry county       4 #D90C60
## 65    Ohio    ohio       pike county       1 #FF0000
## 66    Ohio    ohio     portage county      8 #A61DE0
## 67    Ohio    ohio     preble county       1 #FF0000
## 68    Ohio    ohio     putnam county       2 #F20420
## 70    Ohio    ohio       ross county       5 #CC1180
## 71    Ohio    ohio    sandusky county     12 #5511F7
## 72    Ohio    ohio     scioto county       8 #A61DE0
## 73    Ohio    ohio     seneca county      14 #2A08FB
## 74    Ohio    ohio     shelby county      12 #5511F7
## 75    Ohio    ohio      stark county      15 #1504FD
## 78    Ohio    ohio tuscarawas county      9 #951DF1
## 79    Ohio    ohio      union county       4 #D90C60
## 80    Ohio    ohio    van wert county      6 #BF15A0
## 81    Ohio    ohio     vinton county       4 #D90C60
## 82    Ohio    ohio     warren county       8 #A61DE0
## 83    Ohio    ohio washington county      5 #CC1180
## 84    Ohio    ohio      wayne county       9 #951DF1
## 85    Ohio    ohio   williams county       7 #B319C0
## 86    Ohio    ohio       wood county      11 #6A15F5
## 87    Ohio    ohio    wyandot county       3 #E50840
```

Linear Model VAM 1947 vs Percent 1930

```
vam54Tractor30Mod <- lm(VAM ~ percent_farm_tractor, data = vam1954Tractor30)
plot(vam1954Tractor30$percent_farm_tractor, vam1954Tractor30$VAM, main = "Linear")
abline(vam54Tractor30Mod, col = "red")
```

Linear


```
summary(vam54Tractor30Mod)
```

```
##
## Call:
## lm(formula = VAM ~ percent_farm_tractor, data = vam1954Tractor30)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -454.38 -169.97  -31.25  200.52  568.19
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)            362.38      66.15   5.478 1.01e-06 ***
## percent_farm_tractor   668.33     278.94   2.396   0.0199 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 260.4 on 57 degrees of freedom
## Multiple R-squared:  0.0915, Adjusted R-squared:  0.07556
## F-statistic: 5.741 on 1 and 57 DF,  p-value: 0.01988
```

Residuals from VAM 47 vs. Percent 30

```
vam54Residuals <-data.frame(vam54Tractor30Mod$residuals, vam1954Tractor30$county, vam1954Tractor30)
vam54Residuals
```

```
##     vam54Tractor30Mod.residuals vam1954Tractor30.county  fips county        avg
## 1                   -333.830662                      10 39001     10   9.209961
## 3                    458.885693                      50 39005     50  10.622720
## 4                    261.151609                      70 39007     70  10.609148
## 5                   -143.953658                      90 39009     90  10.169675
## 6                    424.935463                     110 39011    110  10.507224
## 7                   -145.788121                     130 39013    130  10.050313
## 8                   -299.467348                     150 39015    150   9.738122
## 10                   131.777011                     190 39019    190  10.186483
## 11                   -56.083542                     210 39021    210  10.054731
## 13                  -393.609159                     250 39025    250   9.655556
## 14                  -145.666833                     270 39027    270  10.287815
## 15                   351.676015                     290 39029    290  10.306936
## 16                   568.194913                     310 39031    310  10.322308
## 19                  -115.574195                     370 39037    370  10.221900
## 21                    65.306846                     410 39041    410  10.596730
## 23                   323.373865                     450 39045    450  10.074779
## 24                  -293.009476                     470 39047    470   9.944751
## 26                   -13.103671                     510 39051    510  10.567867
## 27                  -341.893966                     530 39053    530   9.078111
## 28                   -56.524400                     550 39055    550  10.072043
## 29                  -180.476459                     570 39057    570  10.698218
## 30                    -6.517941                     590 39059    590  10.159635
## 32                   107.960123                     630 39063    630  10.913314
## 33                  -140.892311                     650 39065    650  10.281763
## 34                  -134.355942                     670 39067    670   9.872080
## 35                  -292.819961                     690 39069    690  10.158685
## 36                  -188.577663                     710 39071    710  10.189036
## 37                    22.315820                     730 39073    730   9.911968
## 38                  -159.471598                     750 39075    750   9.486194
## 39                    61.584464                     770 39077    770  10.674342
## 40                   -31.245282                     790 39079    790   9.540707
## 42                   364.597642                     830 39083    830  10.511027
## 46                   -35.503469                     910 39091    910  10.684086
## 49                  -454.380967                     970 39097    970   9.682366
## 51                   360.849329                    1010 39101   1010  10.490716
## 52                   188.919881                    1030 39103   1030  10.699282
## 53                  -291.525545                    1050 39105   1050   9.727691
## 54                   212.115409                    1070 39107   1070   9.997748
## 56                  -369.649499                    1110 39111   1110   9.436264
## 58                   100.868815                    1150 39115   1150  10.410557
## 59                    89.430331                    1170 39117   1170  10.576296
## 61                  -158.089019                    1210 39121   1210  10.497222
## 62                    15.458297                    1230 39123   1230  10.310724
## 63                  -119.580046                    1250 39125   1250  10.157001
## 64                  -144.910548                    1270 39127   1270  10.021769
## 65                   318.971916                    1310 39131   1310   8.820574
## 66                   353.445466                    1330 39133   1330  10.780847
## 67                  -437.843665                    1350 39135   1350  10.296046
```

```
## 68                310.714882          1370 39137  1370  9.923810
## 70                 82.394415          1410 39141  1410  9.166793
## 72                111.240883          1450 39145  1450  9.300681
## 78                385.486120          1570 39157  1570 10.274903
## 79               -210.944458          1590 39159  1590 10.505435
## 80                 14.922253          1610 39161  1610 10.594572
## 81               -120.815214          1630 39163  1630  9.421053
## 82               -279.485532          1650 39165  1650 10.028030
## 83                408.794698          1670 39167  1670 10.202782
## 85                243.397962          1710 39171  1710 10.532258
## 87               -243.179970          1750 39175  1750 10.314286
##    year.x state.x       name percent_farm_tractor stateAbb colorID.x   logAvg
## 1    1930      39      ADAMS           0.05903146       OH         1 2.220286
## 3    1930      39    ASHLAND           0.19412039       OH         3 2.362995
## 4    1930      39   ASHTABULA          0.22963305       OH         4 2.361717
## 5    1930      39     ATHENS           0.06819313       OH         2 2.319410
## 6    1930      39    AUGLAIZE          0.31674026       OH         5 2.352063
## 7    1930      39    BELMONT           0.07692308       OH         2 2.307604
## 8    1930      39      BROWN           0.08691702       OH         2 2.276048
## 10   1930      39    CARROLL           0.08954394       OH         2 2.321062
## 11   1930      39   CHAMPAIGN          0.27038425       OH         4 2.308043
## 13   1930      39    CLERMONT          0.13500993       OH         2 2.267533
## 14   1930      39    CLINTON           0.31764146       OH         5 2.330960
## 15   1930      39  COLUMBIANA          0.14056832       OH         3 2.332817
## 16   1930      39   COSHOCTON          0.08442982       OH         2 2.334307
## 19   1930      39      DARKE           0.29056995       OH         5 2.324533
## 21   1930      39    DELAWARE          0.22341568       OH         4 2.360545
## 23   1930      39   FAIRFIELD          0.20536013       OH         4 2.310035
## 24   1930      39    FAYETTE           0.40344168       OH         6 2.297045
## 26   1930      39     FULTON           0.32727273       OH         5 2.357818
## 27   1930      39     GALLIA           0.03069700       OH         1 2.205866
## 28   1930      39     GEAUGA           0.25159236       OH         4 2.309764
## 29   1930      39     GREENE           0.30389016       OH         5 2.370077
## 30   1930      39    GUERNSEY          0.05706727       OH         1 2.318423
## 32   1930      39    HANCOCK           0.38403563       OH         6 2.389984
## 33   1930      39     HARDIN           0.27458694       OH         5 2.330372
## 34   1930      39    HARRISON          0.08375778       OH         2 2.289711
## 35   1930      39      HENRY           0.44056493       OH         7 2.318329
## 36   1930      39    HIGHLAND          0.16788079       OH         3 2.321312
## 37   1930      39     HOCKING          0.06030856       OH         1 2.293743
## 38   1930      39      HOLMES          0.14228546       OH         3 2.249838
## 39   1930      39      HURON          0.35018345       OH         6 2.367843
## 40   1930      39     JACKSON          0.04468912       OH         1 2.255568
## 42   1930      39       KNOX          0.13619677       OH         2 2.352425
## 46   1930      39      LOGAN          0.23510204       OH         4 2.368755
## 49   1930      39     MADISON          0.34115409       OH         6 2.270306
## 51   1930      39     MARION          0.37223123       OH         6 2.350491
## 52   1930      39     MEDINA          0.27935677       OH         5 2.370177
## 53   1930      39      MEIGS          0.04959729       OH         1 2.274977
## 54   1930      39     MERCER          0.30599711       OH         5 2.302360
## 56   1930      39     MONROE          0.03482003       OH         1 2.244560
## 58   1930      39     MORGAN          0.03703704       OH         1 2.342820
## 59   1930      39     MORROW          0.15440238       OH         3 2.358615
## 61   1930      39      NOBLE          0.02201122       OH         1 2.351111
```

```
## 62     1930      39      OTTAWA        0.43565976        OH        7 2.333185
## 63     1930      39    PAULDING        0.43870968        OH        7 2.318163
## 64     1930      39       PERRY        0.10553544        OH        2 2.304760
## 65     1930      39        PIKE        0.09673367        OH        2 2.177087
## 66     1930      39     PORTAGE        0.26211135        OH        4 2.377771
## 67     1930      39      PREBLE        0.33586132        OH        5 2.331760
## 68     1930      39      PUTNAM        0.29911504        OH        5 2.294937
## 70     1930      39        ROSS        0.21131448        OH        4 2.215588
## 72     1930      39      SCIOTO        0.12027158        OH        2 2.230088
## 78     1930      39   TUSCARAWAS       0.13636364        OH        3 2.329704
## 79     1930      39       UNION        0.24324324        OH        4 2.351893
## 80     1930      39    VAN WERT        0.29730849        OH        5 2.360342
## 81     1930      39      VINTON        0.05302326        OH        1 2.242947
## 82     1930      39      WARREN        0.27248201        OH        5 2.305384
## 83     1930      39  WASHINGTON       0.05809575        OH        1 2.322660
## 85     1930      39    WILLIAMS        0.29061161        OH        5 2.354443
## 87     1930      39     WYANDOT        0.27950617        OH        5 2.333530
##    logPercent   X.1     X       polyname RUCC             County VAM year.y
## 1  -2.8296848 10021 10021     ohio,adams    9        Adams County  68   1954
## 3  -1.6392767 10031 10031   ohio,ashland    6      Ashland County 951   1954
## 4  -1.4712727 10036 10036 ohio,ashtabula    4    Ashtabula County 777   1954
## 5  -2.6854114 10042 10042    ohio,athens    7       Athens County 264   1954
## 6  -1.1496732 10044 10044   ohio,auglaize   6     Auglaize County 999   1954
## 7  -2.5649494 10051 10051   ohio,belmont    2      Belmont County 268   1954
## 8  -2.4428014 10058 10058     ohio,brown    9        Brown County 121   1954
## 10 -2.4130259 10066 10066    ohio,carroll   6      Carroll County 554   1954
## 11 -1.3079112 10071 10071 ohio,champaign    6    Champaign County 487   1954
## 13 -2.0024070 10081 10081   ohio,clermont   8     Clermont County  59   1954
## 14 -1.1468320 10087 10087    ohio,clinton   6      Clinton County 429   1954
## 15 -1.9620617 10089 10089 ohio,columbiana   4  Columbiana County 808   1954
## 16 -2.4718346 10095 10095   ohio,coshocton  7     Coshocton County 987  1954
## 19 -1.2359109 10110 10110     ohio,darke    6        Darke County 441   1954
## 21 -1.4987212 10123 10123   ohio,delaware   6     Delaware County 577   1954
## 23 -1.5829901 10131 10131  ohio,fairfield   4    Fairfield County 823   1954
## 24 -0.9077233 10138 10138   ohio,fayette    6      Fayette County 339   1954
## 26 -1.1169614 10144 10144     ohio,fulton   6       Fulton County 568   1954
## 27 -3.4835903 10149 10149     ohio,gallia   6       Gallia County  41   1954
## 28 -1.3799451 10155 10155     ohio,geauga   4       Geauga County 474   1954
## 29 -1.1910890 10159 10159     ohio,greene   2       Greene County 385   1954
## 30 -2.8635245 10165 10165   ohio,guernsey   6     Guernsey County 394   1954
## 32 -0.9570199 10178 10178    ohio,hancock   4      Hancock County 727   1954
## 33 -1.2924873 10181 10181    ohio,hardin    6       Hardin County 405   1954
## 34 -2.4798262 10187 10187   ohio,harrison   6     Harrison County 284   1954
## 35 -0.8196974 10190 10190     ohio,henry    6        Henry County 364   1954
## 36 -1.7845011 10198 10198   ohio,highland   7     Highland County 286   1954
## 37 -2.8082813 10200 10200    ohio,hocking   7      Hocking County 425   1954
## 38 -1.9499200 10205 10205     ohio,holmes   6        Holmes County 298   1954
## 39 -1.0492981 10210 10210     ohio,huron    6        Huron County 658   1954
## 40 -3.1080252 10214 10214    ohio,jackson   6      Jackson County 361   1954
## 42 -1.9936546 10225 10225       ohio,knox   7         Knox County 818   1954
## 46 -1.4477356 10245 10245      ohio,logan   7        Logan County 484   1954
## 49 -1.0754210 10263 10263    ohio,madison   6      Madison County 136   1954
## 51 -0.9882400 10272 10272     ohio,marion   5       Marion County 972   1954
## 52 -1.2752656 10277 10277     ohio,medina   6       Medina County 738   1954
```

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```
## 53 -3.0038191 10279 10279       ohio,meigs      7     Meigs County 104    1954
## 54 -1.1841796 10287 10287      ohio,mercer      7    Mercer County 779    1954
## 56 -3.3575624 10296 10296      ohio,monroe      8    Monroe County  16    1954
## 58 -3.2958369 10308 10308      ohio,morgan      9    Morgan County 488    1954
## 59 -1.8681932 10312 10312      ohio,morrow      9    Morrow County 555    1954
## 61 -3.8162029 10322 10322       ohio,noble      8     Noble County 219    1954
## 62 -0.8308937 10328 10328      ohio,ottawa      6    Ottawa County 669    1954
## 63 -0.8239174 10333 10333    ohio,paulding      9  Paulding County 536    1954
## 64 -2.2487085 10335 10335       ohio,perry      7     Perry County 288    1954
## 65 -2.3357938 10346 10346        ohio,pike      9      Pike County 746    1954
## 66 -1.3389859 10349 10349     ohio,portage      6   Portage County 891    1954
## 67 -1.0910569 10354 10354      ohio,preble      6    Preble County 149    1954
## 68 -1.2069270 10360 10360      ohio,putnam      6    Putnam County 873    1954
## 70 -1.5544078 10369 10369        ohio,ross      5      Ross County 586    1954
## 72 -2.1180029 10382 10382      ohio,scioto      4    Scioto County 554    1954
## 78 -1.9924302 10411 10411 ohio,tuscarawas      6 Tuscarawas County 839   1954
## 79 -1.4136933 10414 10414       ohio,union      6     Union County 314    1954
## 80 -1.2129850 10419 10419    ohio,van wert      6  Van Wert County 576    1954
## 81 -2.9370247 10426 10426      ohio,vinton      9    Vinton County 277    1954
## 82 -1.3001827 10433 10433      ohio,warren      6    Warren County 265    1954
## 83 -2.8456628 10435 10435  ohio,washington      7 Washington County 810  1954
## 85 -1.2357676 10446 10446    ohio,williams      7  Williams County 800    1954
## 87 -1.2747309 10456 10456     ohio,wyandot      7   Wyandot County 306    1954
##    state.y state.low       county.low colorID.y    color
## 1     Ohio      ohio      adams county         1 #FF0000
## 3     Ohio      ohio    ashland county        14 #2A08FB
## 4     Ohio      ohio  ashtabula county        12 #5511F7
## 5     Ohio      ohio     athens county         4 #D90C60
## 6     Ohio      ohio    auglaize county       15 #1504FD
## 7     Ohio      ohio    belmont county         4 #D90C60
## 8     Ohio      ohio      brown county         2 #F20420
## 10    Ohio      ohio    carroll county         9 #951DF1
## 11    Ohio      ohio  champaign county         8 #A61DE0
## 13    Ohio      ohio   clermont county         1 #FF0000
## 14    Ohio      ohio    clinton county         7 #B319C0
## 15    Ohio      ohio columbiana county        12 #5511F7
## 16    Ohio      ohio  coshocton county        15 #1504FD
## 19    Ohio      ohio      darke county         7 #B319C0
## 21    Ohio      ohio   delaware county         9 #951DF1
## 23    Ohio      ohio  fairfield county        13 #3F0CF9
## 24    Ohio      ohio    fayette county         5 #CC1180
## 26    Ohio      ohio     fulton county         9 #951DF1
## 27    Ohio      ohio     gallia county         1 #FF0000
## 28    Ohio      ohio     geauga county         7 #B319C0
## 29    Ohio      ohio     greene county         6 #BF15A0
## 30    Ohio      ohio   guernsey county         6 #BF15A0
## 32    Ohio      ohio    hancock county        11 #6A15F5
## 33    Ohio      ohio     hardin county         6 #BF15A0
## 34    Ohio      ohio    harrison county        5 #CC1180
## 35    Ohio      ohio      henry county         6 #BF15A0
## 36    Ohio      ohio   highland county         5 #CC1180
## 37    Ohio      ohio    hocking county         7 #B319C0
## 38    Ohio      ohio     holmes county         5 #CC1180
## 39    Ohio      ohio      huron county        10 #8019F3
```

```
## 40      Ohio      ohio      jackson county           6 #BF15A0
## 42      Ohio      ohio         knox county          13 #3F0CF9
## 46      Ohio      ohio        logan county           8 #A61DE0
## 49      Ohio      ohio      madison county           2 #F20420
## 51      Ohio      ohio       marion county          15 #1504FD
## 52      Ohio      ohio       medina county          11 #6A15F5
## 53      Ohio      ohio        meigs county           2 #F20420
## 54      Ohio      ohio       mercer county          12 #5511F7
## 56      Ohio      ohio       monroe county           1 #FF0000
## 58      Ohio      ohio       morgan county           8 #A61DE0
## 59      Ohio      ohio       morrow county           9 #951DF1
## 61      Ohio      ohio        noble county           4 #D90C60
## 62      Ohio      ohio       ottawa county          10 #8019F3
## 63      Ohio      ohio     paulding county           8 #A61DE0
## 64      Ohio      ohio        perry county           5 #CC1180
## 65      Ohio      ohio         pike county          11 #6A15F5
## 66      Ohio      ohio      portage county          14 #2A08FB
## 67      Ohio      ohio       preble county           3 #E50840
## 68      Ohio      ohio       putnam county          13 #3F0CF9
## 70      Ohio      ohio         ross county           9 #951DF1
## 72      Ohio      ohio       scioto county           9 #951DF1
## 78      Ohio      ohio tuscarawas county          13 #3F0CF9
## 79      Ohio      ohio        union county           5 #CC1180
## 80      Ohio      ohio     van wert county           9 #951DF1
## 81      Ohio      ohio       vinton county           5 #CC1180
## 82      Ohio      ohio       warren county           4 #D90C60
## 83      Ohio      ohio washington county          12 #5511F7
## 85      Ohio      ohio     williams county          12 #5511F7
## 87      Ohio      ohio      wyandot county           5 #CC1180
```
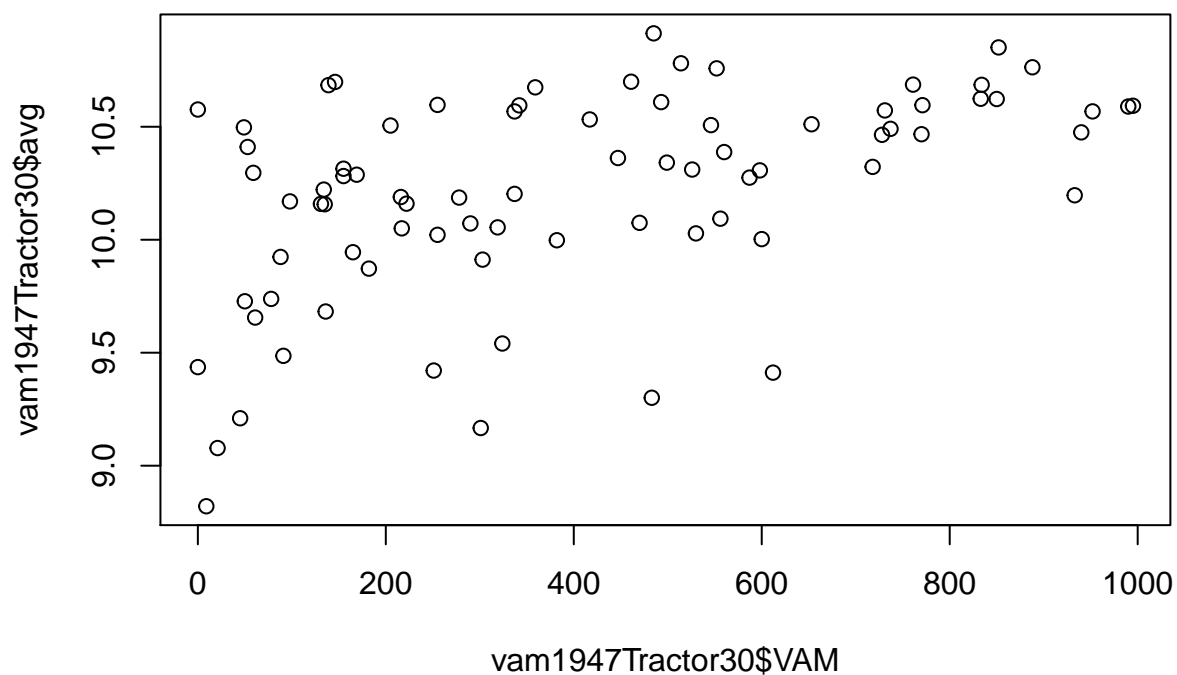
High Education and VAM(1947, 1954)

##1947

```
plot(vam1947Tractor30$VAM, vam1947Tractor30$avg, main = "Education vs. VAM (1947)")
```
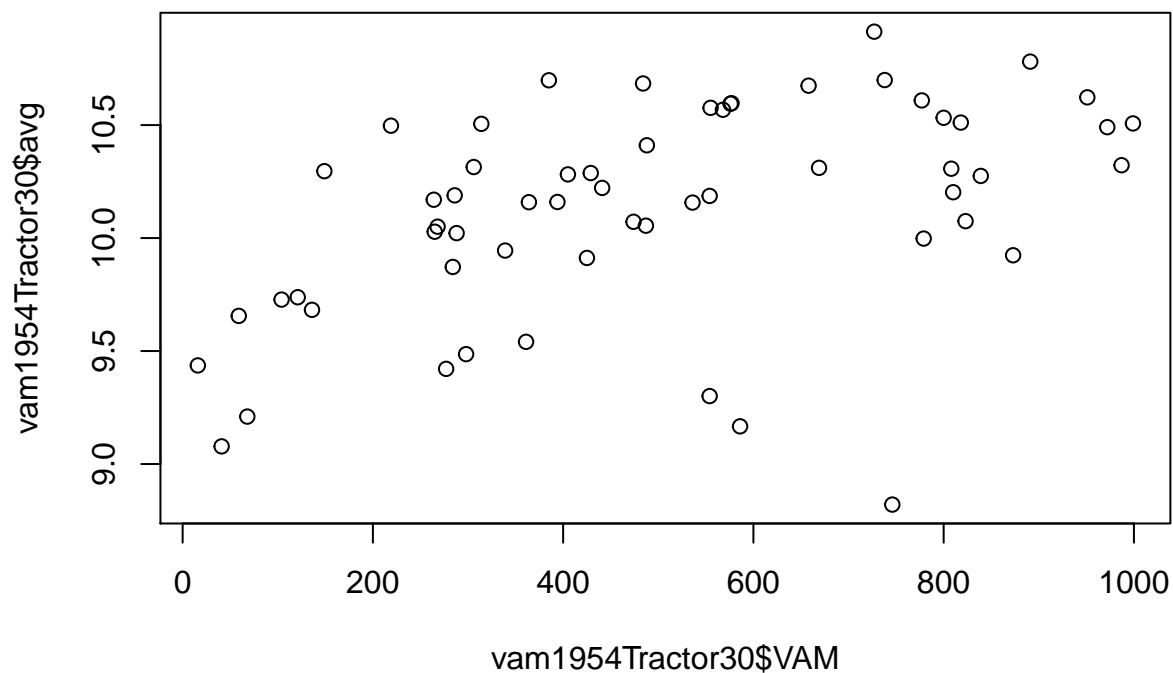
Education vs. VAM (1947)

```r
plot(vam1954Tractor30$VAM, vam1954Tractor30$avg, main = "Education vs. VAM (1954)")
```

Education vs. VAM (1954)

Notice the lowest points going across the X-Axis(On Plot with line connecting outlier counties). These counties identified left-to-right are:

- Pike County
- Ross County
- Madison County
- Fayette County

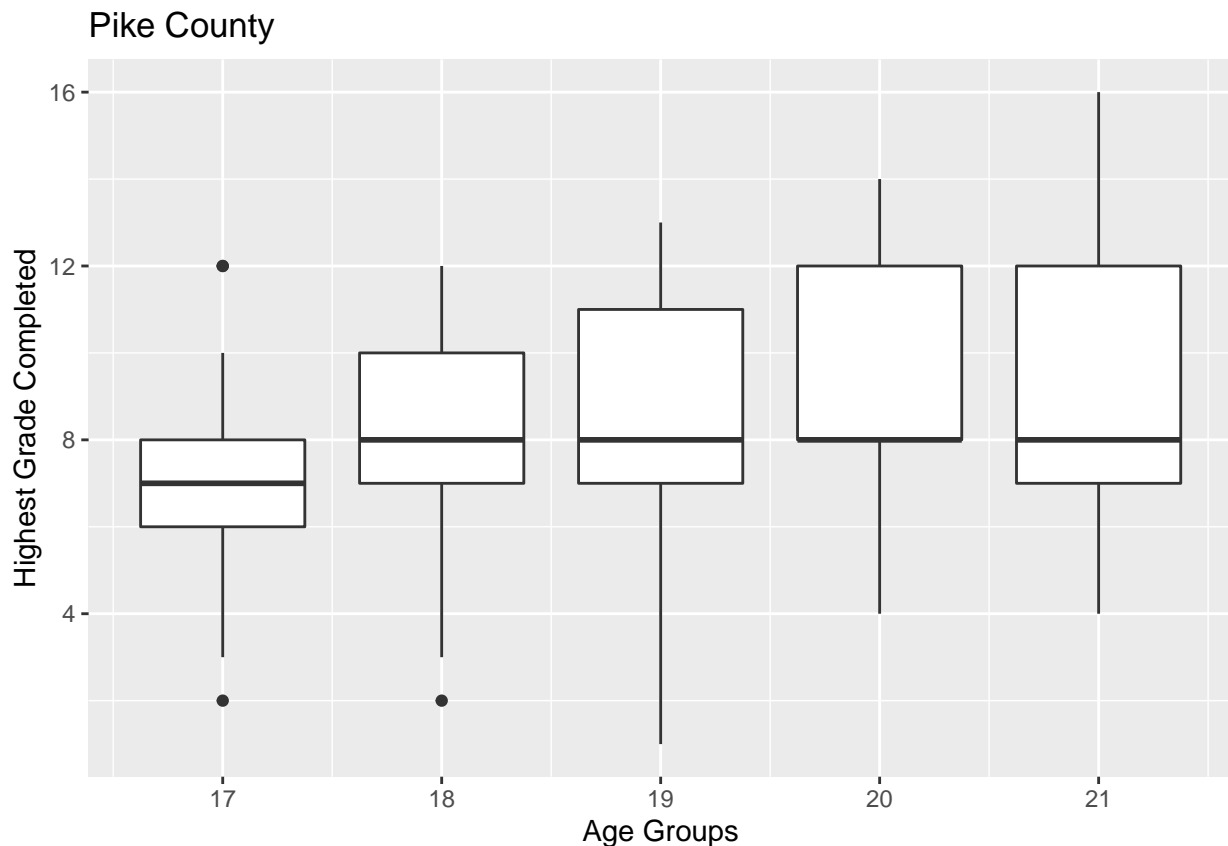The 2 Counties which are overlaying each other and can be seen to the right of the outlier line are

- Paulding County
- Henry County

The objective was to look at the difference in education from 1930 and 1940 and plot that against the % of Farms with Tractors in 1930. The problem I encountered was that the 1930's Education dataset has not features which indicate the highest grade completed for an individual.
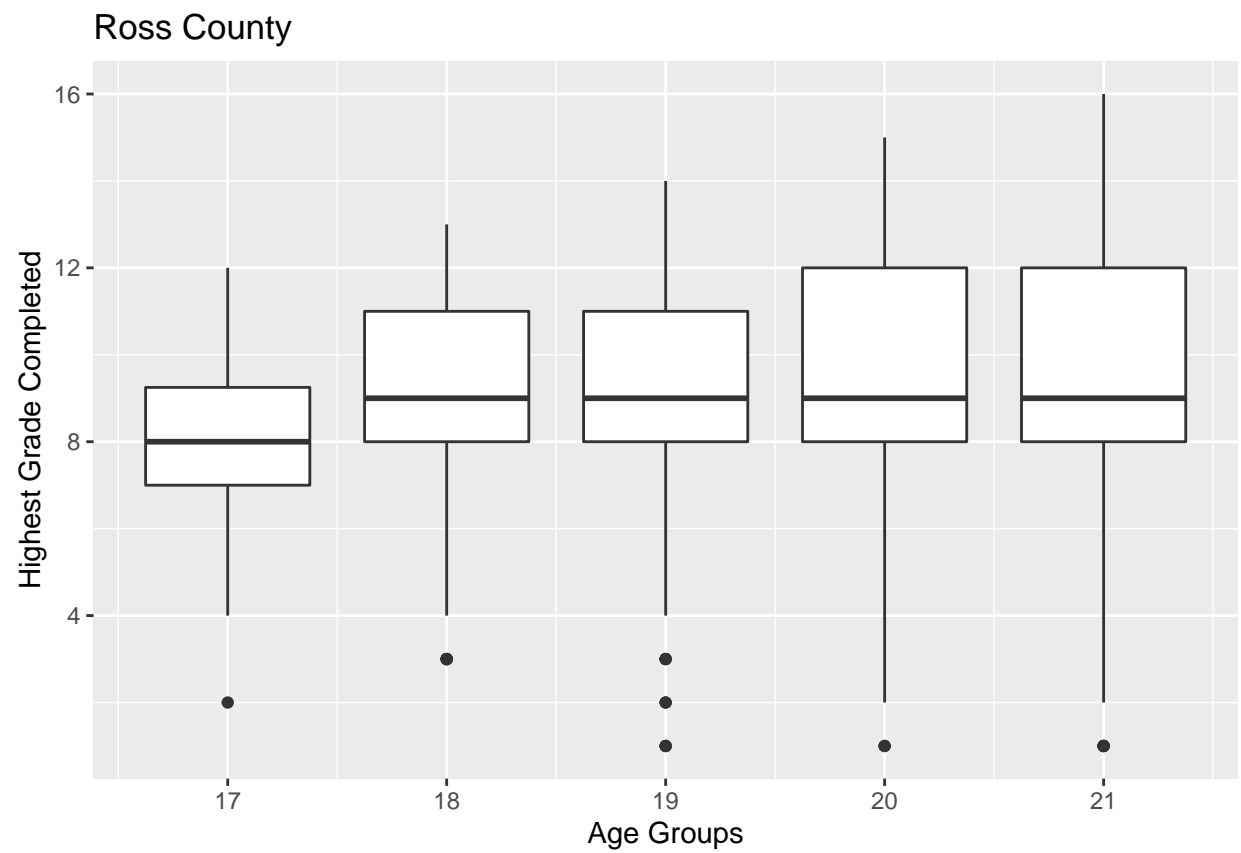
Taking a closer look at the outlier counties listed above(Pike, Ross, Madison, Fayette) but removing everyone who is currently in school, as they could continue their education and in that case the current represented value would not be accurate.

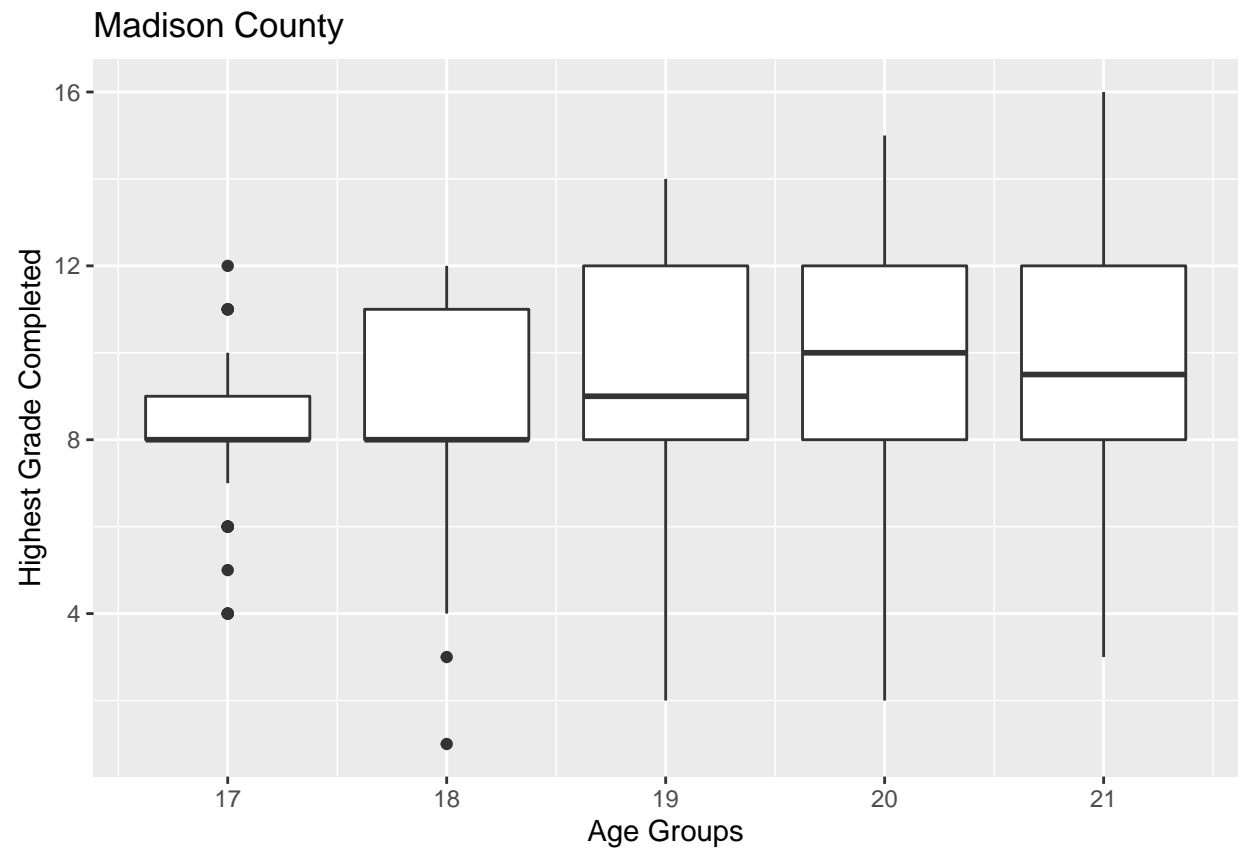**Highest Grade Completed by Age for the 4 outlier counties**

```
pike <- subset(pike, school == "No, not in school")
ggplot(pike, aes(x = age, y = higrade, group = age)) + geom_boxplot() + xlab("Age Groups") + ylab("High
```



```
ross <- subset(ross, school == "No, not in school")
ggplot(ross, aes(x = age, y = higrade, group = age)) + geom_boxplot() + xlab("Age Groups") + ylab("High
```

Ross County


```
madison <- subset(madison, school == "No, not in school")
ggplot(madison, aes(x = age, y = higrade, group = age)) + geom_boxplot() + xlab("Age Groups") + ylab("H
```

Madison County


```r
fayette <- subset(fayette, school == "No, not in school")
ggplot(fayette, aes(x = age, y = higrade, group = age)) + geom_boxplot() + xlab("Age Groups") + ylab("H
```

Fayette County